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MINING WORLD

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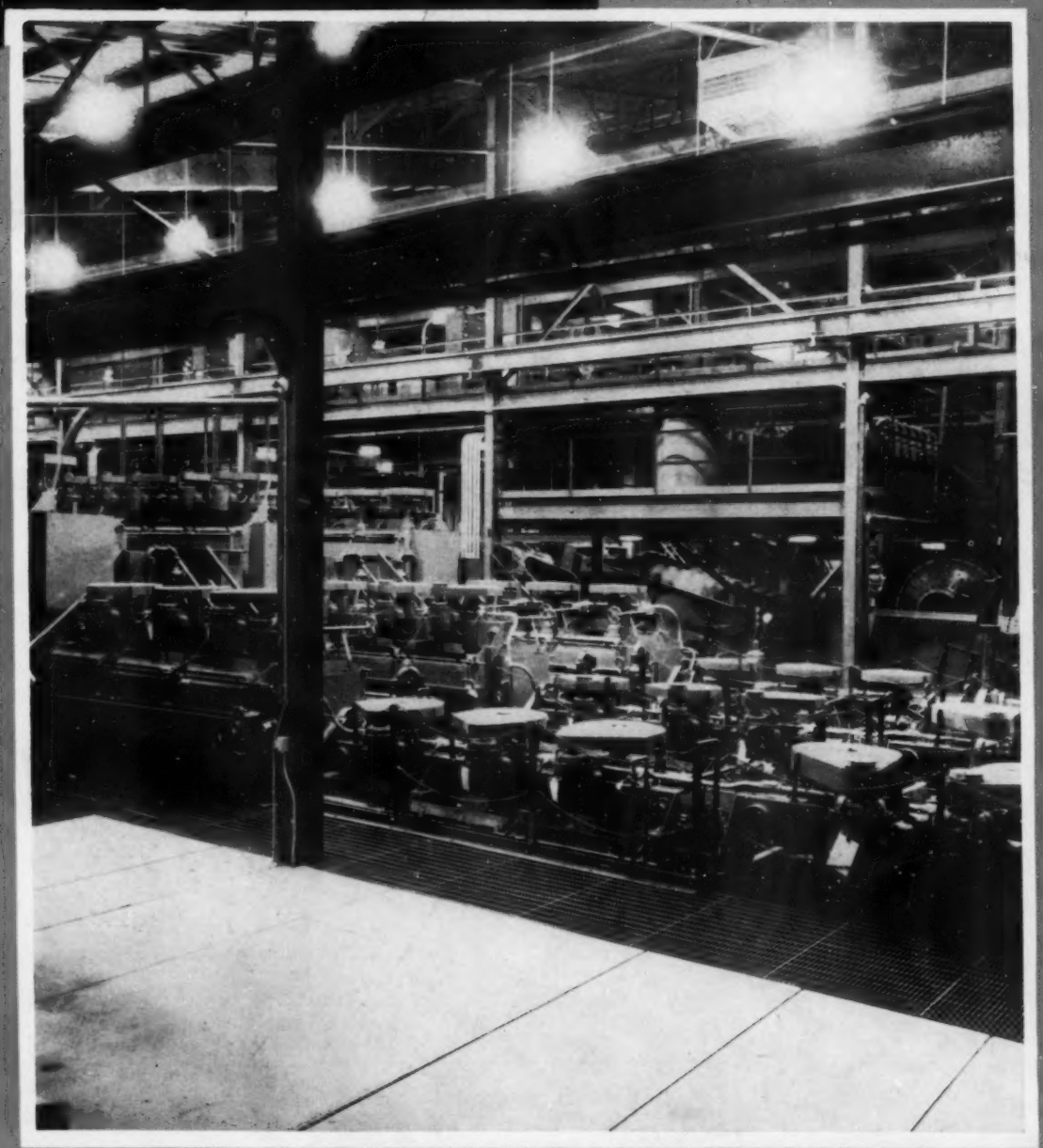

How Republic Floats Michigan Iron Ore

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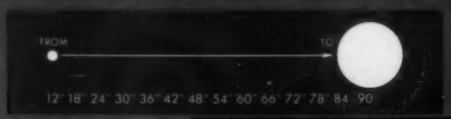

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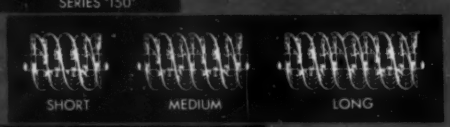

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Mining World

Including the Export Edition **WORLD MINING**

Published monthly except in April when publication is semi-monthly

VOLUME 19 **MARCH 1957** NO. 3

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By Lute J. Parkinson

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By C. V. Isbell

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ON THE COVER

Denver Equipment Company's Sub-A No. 24 flotation machines floating specular hematite at Marquette Iron Mining Company's Republic, Michigan mill. Akins densifier and Hardinge ball mill in background.

READERSHIP Extra RESEARCH

MILLER FREEMAN PUBLICATIONS

GRAB SAMPLES From the Mail

Freezing Not New

Dear Sir:

I was interested in your article which appeared in the September 1956 issue of Mining World, page 81 entitled "How Ice Cooled Diesel Oil Recovers More ore in Wet Shale and Sands" which states that the new method was developed by J. H. Bailey, project manager, D. C. Anderson, chief geologist, et al.

The method was conceived by me when we were drilling a fluorite prospect in sub-zero weather at a U. S. Bureau of Mines project in Vermont during the winter of 1944. Drilling progress was practically nil because of delays due to the water freezing in the drilling circuit. I decided to substitute kerosene for water in the circuit to overcome this trouble and found that not only the freezing difficulty was overcome but that while drilling through the overburden to bedrock the core recovery of overburden was almost perfect and no difficulty was experienced with the hole caving. Because the overburden was only several feet deep on this deposit it was decided to really test the idea at another Bureau of Mines project in New York state where the drilling was through 50 to 110 feet of overburden to bedrock in a swamp. The method worked fine and was used through the project. The method is explained briefly in Diamond Drill Handbook by J. D. Cumming published in 1951, pages 135-145.

Admittedly, the costs were high but the results were excellent. At the time, kerosene seemed preferable to Diesel fuel oil because it does not form a gel on the surface of the dry ice. Currently, there is a greater spread between the cost of Diesel fuel oil and kerosene than at the time we were drilling in New York. Incidentally Sprague and Henwood were the drilling contractors on the job.

Since the method was developed at U. S. Bureau of Mines expense I naturally was required to assign my United States patent to the Department of the Interior; however, I obtained patents in both Canada and Australia.

Another, perhaps equally important application is the substitution of kerosene or Diesel fuel oil for water in the conventional diamond drilling rig during subzero weather. This substitution obviates such adverse conditions as freezing water pipes, time, and expense lost in building fires about pumps and elimination of hauling water to drill sites where water is not available. In many instances, the expense of lost time probably would be less than the cost of the oil and would also permit shut-downs of indefinite length, whether the drilling be in placer ground, overburden, or solid rock.

I simply bring this matter to your attention to advise the freezing method is not new.

John D. Bardill
Spokane, Washington

Glimpse of World Developments

Dear Sir:

We greatly appreciate World Mining as it gives us a glimpse of the developments in various parts of the world.

Managing Director
Oakley Duncan and Co., (Private) Ltd.
Bangalore, India

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Part of the equipment used in the excavating operation at Pima Mine, Arizona. Operations will be completed about January, 1957.

STOODY HARD-FACING in one of the WORLD'S LARGEST OVERBURDEN STRIPPING PROJECTS

A huge stripping operation is in progress a few miles south of Tucson, Arizona, at the Pima Mine where Utah Construction Company is moving 6,000,000 cubic yards of overburden, including 600,000 yards of waste rock, to expose the copper ore deposit 210 feet below the surface. The job was begun in October of 1955 and will probably be completed by January of 1957.

An unusual feature of this project is the method of moving the overburden, a highly abrasive alluvial soil. Instead of the usual blast hole equipment, shovels and dump trucks, the job is primarily handled with rippers and scrapers. After the rippers make a pass, scrapers pushed by crawlers pick up the loose material and haul it to a fill. The equipment inventory includes a D9 Cat ripper, an HD21 A-C ripper, 10 MRS scrapers, two Cat 12 motor graders, six A-C and two D9 Cat pushers, four LLD 30-yard trucks, a Marion 7-yard shovel, a Michigan dozer and two water wagons.

One out of three shifts is devoted to maintenance and repairs. Hard-facing of many pieces of equipment is speeded up by the use of the semi-automatic welder applying Stoody 100. On ripper and bucket teeth which are subject to severest wear, Stoody Tube Borium is applied manually as a final overlay.

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Drifts and Crosscuts

Congratulations To MINING WORLD Plaque Winners

For several years the editors of MINING WORLD have selected the outstanding events, companies, developments, and men of the past year in the January issue.

To express appreciation for these accomplishments and to pay tribute for projects "well done," MINING WORLD has established an annual set of commemorative plaque awards for the following:

The Underground Mine of the Year
The Open Pit Mine of the Year
The Outstanding Small Mining Company of the Year
The Technological Achievement of the Year
The Man of American Mining of the Year

Please turn to page 61 for photographs and a report on the award ceremony in Denver, Colorado on February 8th.

The Editors solicit your suggestions and nominations for the 1957 awards. It's not too early to observe the significant trends and events of this year. As the year draws to a close, you will be asked to make your own nominations.

Treasury Opposes Higher Gold Price

At the eleventh annual meeting of the Board of Governors of the International Monetary Fund in Washington, D. C., the Hon. J. F. Naude, governor for the Union of South Africa, made this statement on the price of gold:

"I do hope, however, that the monetary authorities in all member countries will give serious thought to the question of whether the change in the role assigned to gold under modern monetary management does not call for a new approach to the gold price question."

Not surprising is the immediate official reply of the United States Treasury Department as follows:

"We have listened as always with interest to the arguments offered by the Governor of South Africa in support of his proposal of a higher price for gold. But we find it necessary to state once more that we continue to be opposed to an increase in the official dollar price which we pay for gold. It would conflict with the great objective of our monetary policy, which is to maintain a sound and stable currency both domestically and in international commerce."

It still looks like Congress is the only source of relief for the gold miner.

COMING CONVENTIONS

March 3 through 6. Silver Anniversary Convention of the PROSPECTORS AND DEVELOPERS ASSOCIATION, Toronto, Canada.

March 3rd through 9th, 1957. Joint meeting AMERICAN SOCIETY OF PHOTOGRAMMETRY and AMERICAN CONGRESS ON SURVEYING AND MAPPING, Shoreham Hotel, Washington, D. C

March 11 to 15, 1957. ATOMIC EXPOSITION AND NUCLEAR CONGRESS, Convention Hall, Philadelphia, Pennsylvania.

April 5, and 6, 1957. PACIFIC SOUTHWEST MINERAL INDUSTRY CONFERENCE, sponsored by the Nevada, San Francisco, and Southern California sections of the AIME, Reno, Nevada.

April 16, 17, 1957. HIGH TEMPERATURE MATERIALS CONFERENCE, Cleveland Section of the AIME, Hotel Carter, Cleveland, Ohio.

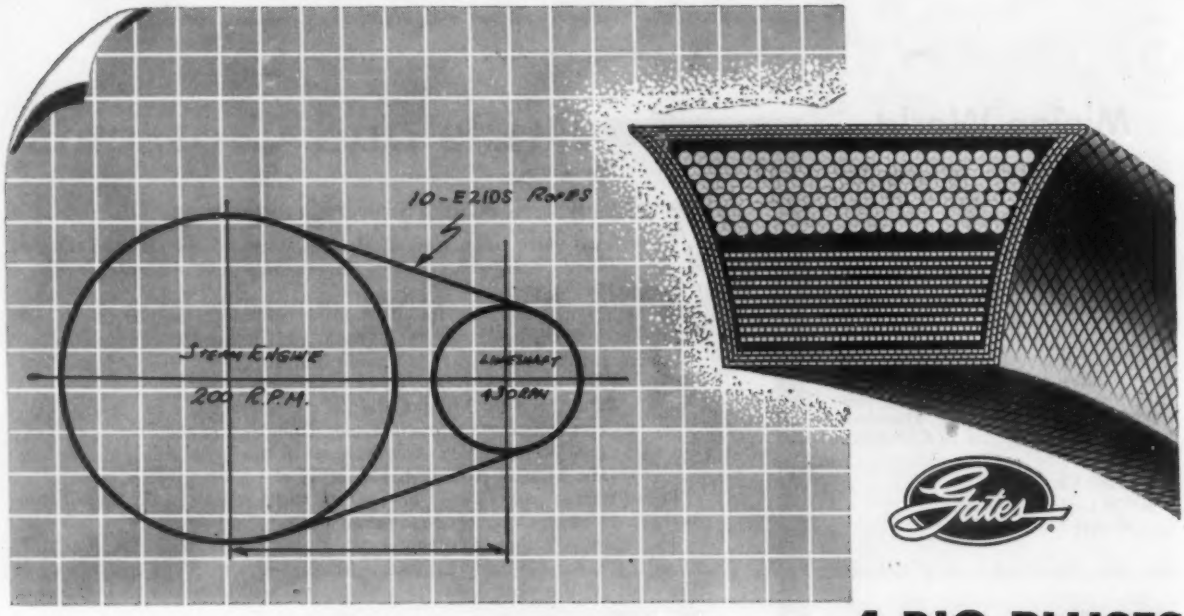
April 21 through 24. Second annual SYMPOSIUM ON ROCK MECHANICS Colorado School of Mines, Golden, Colorado.

May 6, 7, and 8. Meeting of the INSTITUTE ON LAKE SUPERIOR GEOLOGY, Michigan State University, East Lansing, Michigan.

May 28, 29, 1957. SECOND REACTIVE METALS CONFERENCE, Southern California Section of AIME, Ambassador Hotel, Los Angeles, California.

July 14, 15, and 16. The 54th Annual Convention of the IDAHO MINING ASSOCIATION, Sun Valley, Idaho.

September 18 through 21, 1957. INTERNATIONAL MINERAL DRESSING CONFERENCE, Royal Institute of Technology, Stockholm, Sweden.



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Capitol Concentrates

Long Range Mineral Program Not Ready to be Submitted to Congress

Some time ago Chairman James E. Murray of the Senate Interior Committee wrote to Secretary Fred Seaton of the Interior Department notifying him that the committee was organized and ready to receive his draft of long-range mineral legislation. Murray pointed out that mineral bills are being withheld waiting for the Seaton-Wormser plan, and that it will take time for the committee and staff to study the recommendations. He also asked for a time table.

As Secretary Seaton was in Alaska, Assistant Secretary for Mineral Resources Wormser answered the letter saying: "This document is not yet ready for submission to the Congress, but as you know we are desirous of cooperating with you to the utmost, in the adoption of a program in the public interest and of benefit to the mining industry. You may rest assured that we are planning to provide you with a draft of our program just as soon as it is available."

A more indefinite answer would be hard to imagine.

Chairman Engle of the House Interior Committee had no more luck when he made a similar inquiry several weeks previously.

• Beam Plan For Gold Explained

Congress is being circulated with literature boosting the "Beam Plan" for restoring the domestic gold mining industry. This plan (according to the circular letter) has the unanimous and enthusiastic endorsement of the Nevada Legislature and the California Legislative Committee.

The Beam Plan appears to be a throwback to the days when a producer could ship to the mint and receive back the equivalent of his bullion (less a small charge) in gold coin of the realm. However, the new plan proposes "that the United States Mint receive gold for processing as now, but that it return to the producer upon request, coins for his gold, stamped by content of gold rather than by value, such as 'one ounce,' 'one-half ounce,' etc. The plan applies only to newly mined gold." The implication of the word "coin" is not exactly clear. Probably "gold tokens" would be a better designation as it is stated, "The gold producer then may keep, sell, or use his coins on an open market at whatever price it may bring."

The plan also seeks to terminate the Treasury policy of selling government gold for use in the arts. Consequently, it must consider that these "coins" are, in effect, small gold bars for general use, rather than coins. There apparently is no provision for stamping the fineness or arranging for a durable alloy rather than pure gold, hence very little "pocket circulation" is expected. It may also be wondered what provision would be made against the adulteration or counterfeiting of such "coins."

There seems to be little difference in the actual operation of the Beam Plan and various bills before the Congress calling for the free circulation of newly mined gold plus cessation of Treasury sales to the arts. Any bill drafted to put the Beam Plan into operation will meet the same resistance and will gather the same dust in the House and Senate Banking and Currency Committees as all the other bills aimed at restoring gold to free circulation, free coinage and free sale are doomed to collect.

• Gold Bill Has Interesting Feature

An interesting feature is contained in a new gold bill by Representative Clair Engle of California. One section of the measure (H.R. 625) states that all gold held or bought by the United States Treasury, or mints, or assay offices, or by Federal Reserve Banks, shall be construed to be monetary gold and none of this gold may afterward be sold for commercial use or the arts; also, that none of this gold may be sold in any domestic or Territorial free market for the purpose of depressing the price of gold. Such a provision will meet, no doubt, with strong resistance from the Administration. Other features of the bill are the removal of import and export restrictions and, in fact, "any restrictions whatsoever." The Treasury Department certainly would fight the bill were there any chance of a favorable report on it by the House Banking and Currency Committee—which there is not.

• Direct Relief Asked For MacArthur Company

Senator Schoeppel of Kansas has introduced a private bill for the relief of the MacArthur Mining Company, Inc., a matter arising out of the Premium Price Plan.

Although this company obtained the maximum zinc-lead premiums, it maintained that the plan encompassed the idea that premium limits should be expanded to take care of rising costs. A suit in the lower courts resulted in a clear-cut victory for MacArthur, which later was reversed on appeal. A curious factor in the current bill, S. 263, orders a direct payment from the Treasury to MacArthur, whereas similar bills in the past have merely assigned to the Court of Claims the chore of making a report to the Congress on the merits of the claim. The idea, no doubt, has been that should the report be favorable a direct-relief bill would be introduced. It is rather remarkable that other companies have not tried this mode of attack after being turned down by the Contract Settlement Board of the Federal Courts.

• Meeting of Tungsten Producers Planned

It is understood that Congressman Clair Engle, chairman of the House Interior and Insular Affairs Committee, has called an informal meeting of certain tungsten producers, in San Francisco, probably February 16 and 17, to discuss a long-range program for the domestic tungsten industry. Some members of the minerals subcommittees of the Senate and House, in all likelihood, will be present. As Secretary of the Interior Seaton has not yet presented his long-range mineral program to the Congress it may be

that Engle is somewhat premature in calling the San Francisco meeting.

• New Appropriations Are Required

The mineral purchase act, Public Law 733, 84th Congress, was passed too late in the year to secure the full $91 million required to finance the program, but $21 million was authorized in the last supplemental appropriation bill to pass before Congress adjourned. This amount proved to be too small to carry the tungsten program through. In fact, the government's tungsten program had to be cut off because of lack of funds and is not now operating. As it generally takes several months to pass the main appropriation bill, it is customary for the Congress to pass one or more supplemental bills to provide money for continuing programs in the interim period.

The Department of Interior has prevailed on the Bureau of the Budget to ask the Congress for $30 million to carry the administration of Public Law 733 through to June 1957, when the general appropriation bill would go into effect. An additional $40 million will have to be appropriated for the regular fiscal 1958 budget. So far, only tungsten has been affected by the money shortage.

• Phosphate Lease Bill Is Reintroduced

Senators Murray, Mansfield and Scott have introduced S. 334, a bill to increase the total acreage of phosphate lease holdings in any one state from 5,120 acres to 10,240 acres. This proposal does not increase the limitation on total holdings for one producer within the United States. A similar and companion bill was offered in the House by Representative Walter S. Baring of Nevada. The Senate passed such a bill last year, but too late in the session for House action. The bill has the approval of the Administration.

• Hearings Planned On Multiple-Use Act

Congressman Clair Engle, chairman of the House Interior Committee, has criticized the administrative procedures set up under an act of the 84th Congress to provide for the multiple use of certain public lands. He insists that it was not the intent of Congress to interfere with, or jeopardize, the titles of legitimate mining claims. In letters to the Secretary of Interior and Secretary of Agriculture, Engle stated:

"It was never intended that the procedures set forth under the terms of the act would be used to bring the legitimate mining claimant to task and to serve as a dragnet to recapture for the federal government certain surface rights to bona fide mining claims located prior to July 23, 1955."

The committee chairman has requested the agencies to submit a detailed report on their regulations pertaining to the new act. This information, he said, will be used in connection with a series of hearings by his committee on the operation of the law. Engle reported that he has received a number of complaints from holders of unpatented mining claims, who charge, in effect, that the two federal agencies are challenging their rights to their claims.

• Excess Land Holdings Bring Criticism

Congressman Engle of California has renewed his fight for legislation which will limit the Department of Defense in its arbitrary withdrawals of public lands for military purposes. Under his new bill (H.R. 627), the Congress would have to pass on any withdrawals of public lands aggregating more than 5,000 acres for any defense purpose or project. There have been bitter complaints that the military departments hold lands far in excess of their requirements.

• Mine Inspection Hearings Are Published

"Mine Safety" is the title of a report issued by the Committee on Education and Labor, House of Representatives. It covers the hearings held by the Subcommittee on Mine Safety and Health Inspections and Investigations in Minnesota, Montana, Colorado, and Washington, D. C.

The printed volume runs to more than 600 pages and contains a great amount of interesting information. It covers bills relating to inspection and investigations in metallic and nonmetallic mines and quarries (excluding coal and lignite mines) and for the purpose of obtaining information relating to health, safety conditions, accidents, and occupational diseases such as silicosis. Copies may be obtained from the House Committee on Education and Labor.

Members of the subcommittee which conducted the hearings were Democrats Lee Metcalf of Montana, Carl Elliott of Alabama, Phil M. Landrum of Georgia, and Republicans John J. Rhodes of Arizona and Orvin B. Fjare of Montana. Their recommendation was for further study of the proposals.

• Fluorspar Regulation Equalizes Freight

The regulations for purchases of metallurgical-grade fluorspar, as originally set up by the Office of Defense Mobilization, contained an East-West freight differential of $6.00 per ton. This provision made it unprofitable to produce metallurgical-grade fluorspar end, therefore, all the effort was going into making acid grade. It was pointed out to ODM Director Flemming that this differential was defeating his purpose in creating the metallurgical program as his interest was to increase metallurgical production rather than acid grade. As a result, Director Flemming issued orders on December 21, 1956, to equalize the price to all mines whatever their location. The fluorspar purchase policy now meshes in with the Congressional policy set up in Public Law 733 although ODM was not bound by this Act.

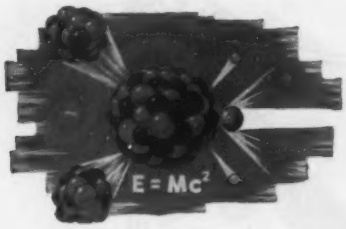
• Russian Slogans Play Up Mining

On the thirty-ninth anniversary of the "Great October Socialist Revolution" the U.S.S.R. Central Committee concocted a set of slogans to cover almost every phase of Soviet policy—external and internal. Slogan No. 48 says: "Soviet geologists! Prospect more rapidly the mineral wealth of the country, open new deposits of iron, coal, oil, gas and nonferrous and rare metals!" Another one says: "Speed up the building of mining enterprises and metallurgical plants! More pig iron, steel, nonferrous metals and rare metals for the national economy!"

There are times when it seems that the slogan for the United States of America, if it had one, would be: "Import more metals and barter for more metals and keep the domestic mining industry from expanding!"

We Wish Them Luck

It sounds so familiar! The Chinese and the Russians have been dumping antimony in England. So producers are applying to the Board of Trade (evidently equivalent to our Tariff Commission) for increased duties. Let's hope they have more luck than our domestic fluorspar producers (and producers of other metals and minerals) have had.



FISSION FACTS

Monthly Roundup of Mining News In the Atomic Energy Field

The Growing Trend To Uranium Up-Grading Revives An Old Concentration Method

Everybody in the uranium business is talking about upgrading and the new upgrading plants. Actually, physical process upgrading is not new at all. The old Joe Junior mill at the exact spot where Uravan, Colorado now stands was really an upgrading plant when it operated 35 years ago. The process was the same—that is, to scrub and/or abrade the uranium-rich fines away from the harder sandstone gangue grains, and then to separate the two components—an upgraded concentrate with up to a 10-to-one concentration ratio, and a sand tailing.

Both wet and dry concentration methods have been used. More experimentation has been done on dry processes because of the greater applications for a successful plant in the desert areas of the Plateau; in fact, over 40 years ago the National Radium Institute concentrated 1,200 tons of uranium ore at Long Park, Colorado by a dry process. The ore assayed 0.85 percent U_3O_8 and was considered low grade at that time. Recovery was about 60 percent with a concentration ratio between 5 and 6 to 1. In the final analysis, the wet process is to be preferred because it permits better preparation before sizing and closer controlled sizing before concentration.

For many typical Plateau ores vanadium content is the difference between profit and loss in any upgrading process. As a rule the recovery and concentration ratio for vanadium minerals is the same as for uranium—exactly so, of course, when the uranium-vanadium mineral carnotite is being treated at the older mines. More recent discoveries have lower vanadium content so the uranium must be higher to make upgrading economical.

There are several reasons for the upgraders. There is a large tonnage of 0.05 to 0.15 percent U_3O_8-bearing rock at operating mines and in undeveloped reserves. This is too low grade to sell directly to many mills, but it must be handled and separated at the mines. By upgrading, a saleable concentrate can be made from it and mineralized rock then becomes low-grade ore. Also, with the long trucking distances from many mines to mills, it is uneconomical to truck low grade to mills even if the mills will buy it. Upgrading would really boom if the government trucking allowance were ever discontinued.

Upgrading is possible for almost any ore. However, there is a wide range of ore types so no general rule can be applied. The proposed plant of Northwest Uranium Mines, Inc. in Washington will be watched with interest because the ore is different than normal Plateau type.

Ideally the ore should have coarse grained hard sand particles cemented only by ore minerals. However, almost every ore has other cementing materials, such as gypsum, calcite, clay, and carbonaceous matter. These softer materials dilute the concentrate, adversely lowering its grade. Some ores with a fine grained sandstone gangue also present difficult problems because of sand-slime separation problems.

One of the largest and most successful upgrading plants has been operated for several years by the Vanadium Corporation of America at its Monument No. 2 mine in Monument Valley, Arizona. Low-grade vanadium-uranium ore mined, of necessity, in normal pit and stripping operations is treated in two units with a 300-ton-per-day capacity. Fortunately mineralization is in a coarse grained Shinarump conglomerate with low lime and clay content.

Ore is crushed and subjected to a controlled grind in rod mills. Pulp from rod mills flows to Akins classifiers; overflow is concentrate which is pumped to a thickened. Classifier sand containing some values in the slime fraction is treated in a Telluride Iron Works cyclone which recovers slime, saves water, and makes finished sand tailing. Recovery and grade of concentrate can be varied by changing density in classifier.

Typical metallurgical data at VCA plant was given by Fred A. Brinker, chief metallurgist, Western Division of the Vanadium Corporation of America, at the Colorado Mining Association's convention in Denver, Colorado, February 3, 1956, as follows: Heads 0.50 to 1.00 percent V_2O_5 and 0.05 to 0.10 percent U_3O_8. Ratio of concentration 5 to 1, and up to 6.5 to 1. Recoveries between 60 and 70 percent for both vanadium and uranium. Concentrate screen size is 2 to 3 percent plus-65-mesh. Cone sand tailing is 5 percent plus-20-mesh with 8 to 10 percent minus-100-mesh.

In mid-1956 the Union Carbide Nuclear Company announced plans for upgrading plants at Slick Rock, Colorado and Green River, Utah. While no details have been announced, it is known that both plants will use a new chemical upgrading process in contrast to physical processes of other plants.

WYOMING upgrading plants include Shawano Development Corporation's mill near Baggs, Wyoming with a daily capacity of 100 tons of ore; Gila Uranium Company, reported to have built a 100-ton-per-day plant to treat ore from its Orr claims in the Pumpkin Buttes area; Vitro Uranium Corporation, major ore producer in the Gas Hills district, considering plans to build an upgrader with the concentrate being shipped to Vitro's mill at Salt Lake City, Utah for refining. The Ore Benefication Company of Salt Lake City has been testing a truck-trailer mounted dry plant at Riverton. Several companies are reported interested in the plant. In December the Mt. Hi Uranium and Oil Corporation of Casper was negotiating for an upgrading plant to treat ore from two of its mines southwest of Pumpkin Buttes, Wyoming. Carnotite and autunite are found in Fort Union sandstone.

SOUTH DAKOTA will have a major plant if plans of Pictograph Mining and Uranium Company of Edgemont materialize. The plant is scheduled for construction in Craven's Canyon north of Edgemont. About 300 tons of 0.11 percent U_3O_8 (carnotite) ore will be treated daily. Mining will be by open pitting in an area where 450,000 tons have reportedly been drilled out.

UTAH plants include Santa Fe Western Gas and Uranium Company's operation to treat ore from the Waterfall claims in Dry Valley. The Mio Dio Uranium Corporation is operating a plant to treat about 400 tons of ore per day from its Billys Dream claims at Notom Bench. Concentrate is sold to Vitro at Salt Lake City. Cog Minerals is building plant in Fry Canyon, San Juan County. Mountain Mesa Uranium Company is considering use of the dry Tripp process for low-grade ores.

WASHINGTON upgrading plans have been disclosed by Northwest Uranium Mines, Inc., which is studying a chemical process to treat low-grade ores already developed on the Spokane Indian Reservation.

Many of the plants are faced with the problem of recovery with the simple methods used. In some instances, only a low concentration ratio is possible when making a satisfactory recovery. All wet plants are faced with concentrate drying problems. It must be low cost, so decantation, settling, and solar drying are used. Settling agents have proved very advantageous.

Argentina Reveals Status Of Its Uranium Deposits

At least 150 radioactive ore deposits in the form of 12 uranium minerals reportedly have been located in Argentina. At present 12 mines are in production, sending ore to concentration plants of the National Committee on Atomic Energy in Cordoba and Mendoza. This committee is an official agency of the national government, and the sole purchaser of uranium minerals.

The principal uranium deposits are Santa Brigida and San Victorio, near Sanogasta in La Rioja province. From these are mined the highest grades of uranium-bearing minerals in the country.

The uranium deposits of Papagayos, Cerro Huemul, and Agua Botada in Mendoza are the largest deposits in amount of ore contained but are of lower grade.

The National Committee presently operates a modern up-to-date laboratory for uranium research. In the planning stage is purchase of a nuclear reactor.

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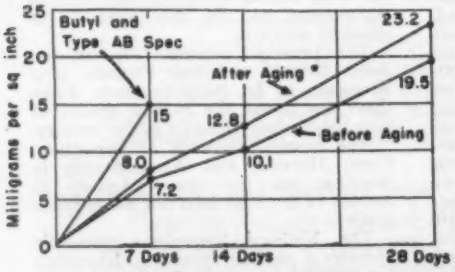
ANACONDA TYPE SH-D Shovel Cable with neoprene jacket, Type AB butyl insulation—a good companion in wet locations.

New champ in the "old swimming hole"

—Anaconda Type AB butyl-insulated Shovel Cable



RESULTS OF mechanical moisture absorption test show Type AB absorbs less than *half* the moisture Industry Specifications allow.

Where shovel cable is exposed to rain, snow or wet spots — moisture-resistant properties of the jacket *and insulation* are vitally important.

Latest test results show Anaconda Type AB butyl insulation (used in Anaconda Shovel Cable) *absorbs far less moisture* than the criterion set up by Industry Standards.

Result: longer cable life . . . greater freedom from failure . . . less down time for users of Anaconda Type AB-insulated Shovel Cable.

NEW ENGINEERING BULLETIN EB-27 has full details on performance of Anaconda butyl insulation in 15 Industry Specification tests. Ask the Man from Anaconda for your copy. And see your Anaconda distributor for your Shovel Cable. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 67319

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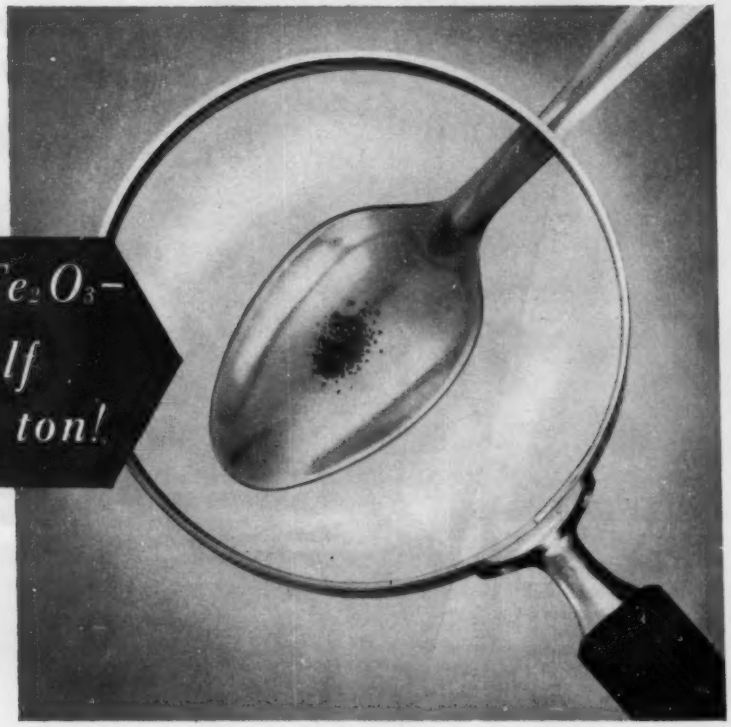

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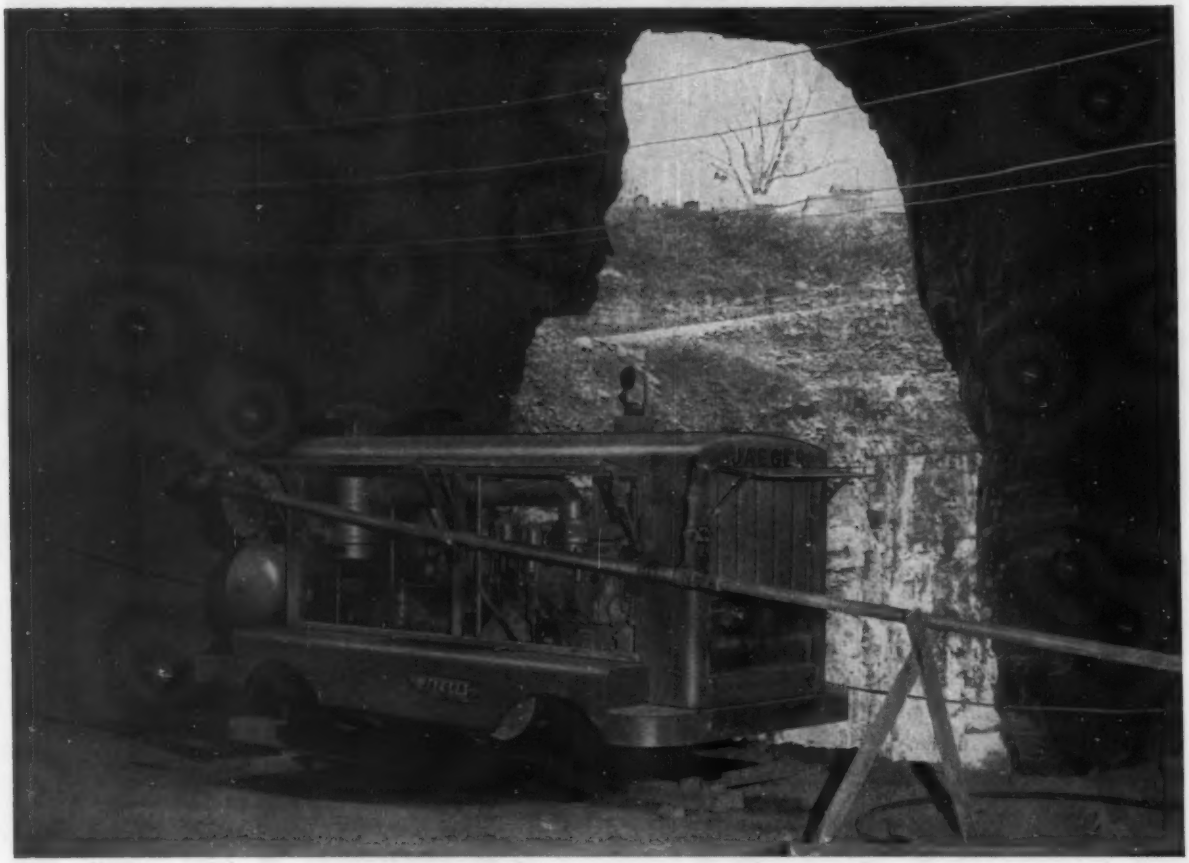

400 FT. (IN 12-18 FT. DEPTHS) PER 8-HOUR SHIFT, IN HARD MISSOURI LIMESTONE, ON 36 GALLONS OF FUEL

This is average day's work of this Jaeger "600" Rotary Compressor and two 4" drifters, in Federal Materials Company's underground quarry at Cape Girardeau, Missouri. A. W. Zimmer, Jr., Secretary-Treasurer and Manager, reports: "We are more than 100% satisfied with the performance of the Jaeger rotary compressor. Efficiency and fuel economy are remarkable and, except for regular filter changes, maintenance expense has been zero."

Jaeger 600 Rotary ...*brings new efficiency to drilling*

A Jaeger "600" rotary produces the same 600 cfm of air as other "600" compressors, *using the same 6-71 GM diesel engine at 100 to 150 rpm slower speed (1650 rpm instead of 1750 or 1800).*

This explains why Federal Materials Company can keep two 4" drifters drilling 8 hours in hard rock on only 36 gallons of fuel. You use less fuel, subject your engine to less wear, and turn your compressor as many as 9000 fewer revolutions every hour you work.

Smaller Jaeger Roto Air Plus® units have the same low speed, high efficiency performance. It will pay you to get full details or demonstration from your Jaeger distributor —or let us mail you Catalog JCR-5.

CRAWLER AND BOOM MOUNTINGS for both 4" drifters was designed by Federal Materials Co. to fit their particular needs.

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HERE'S A MAN-SIZED JOB

This is one of six CAT* DW21s with No. 21 Scrapers which handled *one million tons of clay and rock* during a Nevada winter. Working 20 hours a day, six days a week, these machines stripped overburden at a copper pit near Kimberly. Each unit loaded 15 bank yards in one minute (push-loaded by a Caterpillar D8 Tractor), made the half-mile round-trip haul, and then dumped in 25 seconds. These fast-working yellow rigs are owned by Young & Smith Construction Co. of Salt Lake City, Utah.

Outstanding though this production record is, there is now a *new* Caterpillar DW21 (Series C) and No. 470 Scraper with LOWBOWL design which will move even *more* material in *shorter* time at *less* cost per yard. Its new four-cycle diesel engine develops 300 HP (maximum output) and has a Turbocharger which packs in air according to load, not speed, for more working horsepower and greater performance.

With LOWBOWL design, the 25-yard (heaped capacity) No. 470 Scraper can handle bigger payloads faster than ever before. The bowl is shallower, wider and longer than old-fashioned scrapers for less resistance throughout the loading cycle. In on-the-job tests, the Cat DW21 and No. 470 Scraper handled at least 20% more material than any other unit in its class.

Whether for coal or metal mining, the application of the Caterpillar DW21 and No. 470 Scraper is the same. With ample power, large capacity, and wide-footprint tubeless tires for good flotation, this big yellow team can speed production and cut costs on *your* operation. Your Caterpillar Dealer—who provides skilled service and parts you can trust—will gladly give you full details. Call him soon.

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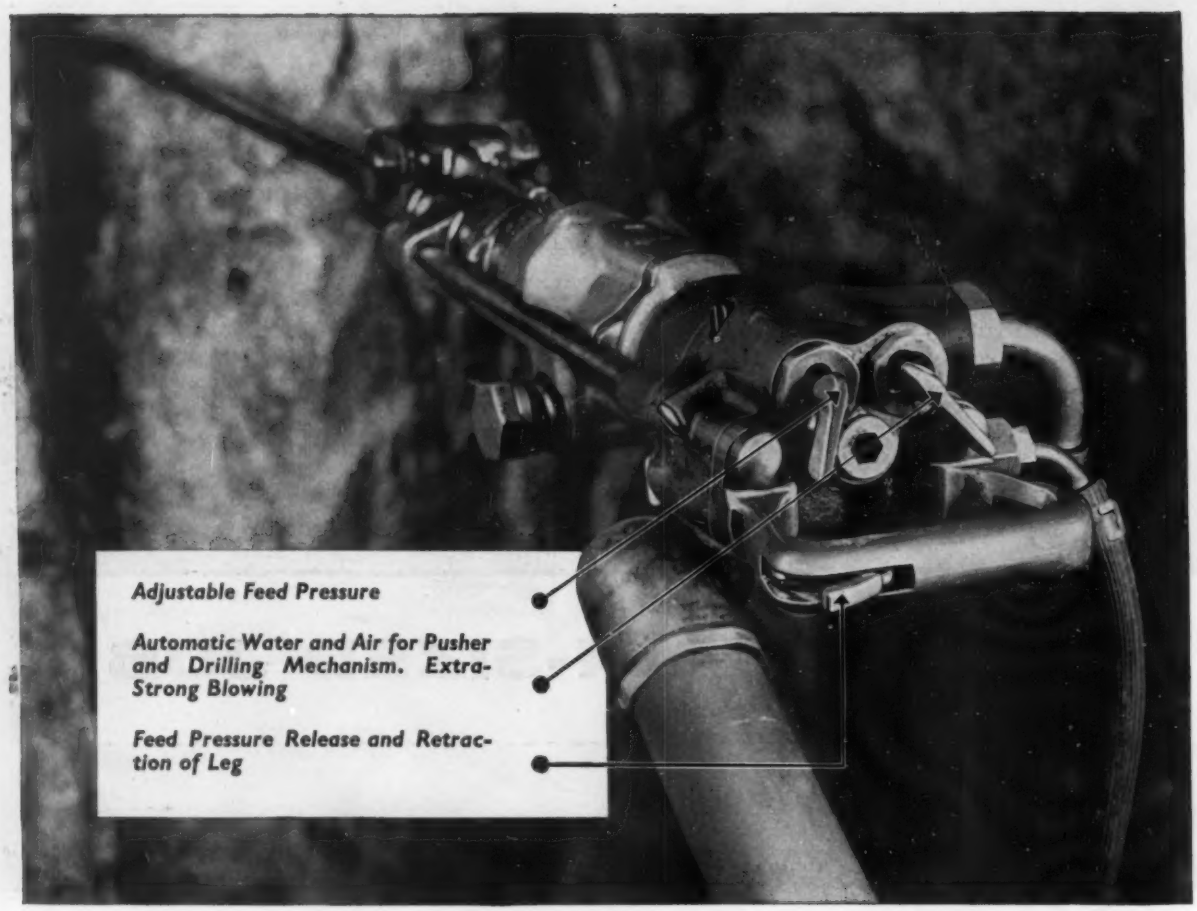

Adjustable Feed Pressure
Automatic Water and Air for Pusher and Drilling Mechanism. Extra-Strong Blowing
Feed Pressure Release and Retraction of Leg

RETRACTABLE LEG AND ONE-HAND GRIP-CONTROLS SPEED DRILLING TIME

For years Atlas Copco have been the world's largest manufacturers of pusher leg drills. Since 1937 when Atlas Copco, far ahead of any other manufacturer, introduced their first pusher leg drills, they have continuously improved the design of these drills. Their latest development, the Atlas Copco 'Lion', combines an unequalled ease of operation together with a high drilling rate—both contributing to a higher footage per manshift.

All controls under one hand

The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. *Full control without having to move the hand from the backhead!*

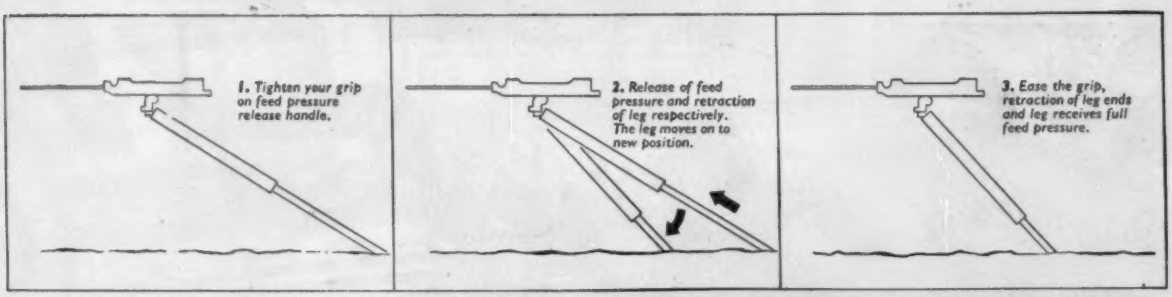
The valves are all easy to operate. By the use of only the fingertips the drill can be started or shut off, the feed can be adjusted to the pressure required, or retracted for an advance, and the extra air-blowing can be brought on to clean the holes.

All the control handles have been designed in such a way that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

Retractable leg saves time

When the leg has to be moved the feed pressure is easily released by squeezing the hand grip. By further pressure on the grip the leg retracts automatically.

Pusher leg moves forward with drill in full action


1. Tighten your grip on feed pressure release handle.
2. Release of feed pressure and retraction of leg respectively. The leg moves on to new position.
3. Ease the grip, retraction of leg ends and leg receives full feed pressure.

When the leg is in the new position suitable for continuous drilling, retraction stops and the feed pressure comes back by loosening the grip of the hand. *All this can be done while the drill is still running.*

This new idea of a retractable leg enables quicker repositioning of the leg and reduces the number of steel changes, thereby increasing footage per manshift. When drilling high holes it is now far easier to alter the position of the leg more frequently in order to maintain an optimal feed angle and feed pressure.

Packed with power for deep holes

The Lion has a drilling rate at least 30% higher than other rock drills of the same weight. Furthermore, it is designed so that it can maintain its high speed *even when drilling deep holes.* This means quickly drilled deep hole rounds and a faster, steadier advance. You'll also find that the Lion reduces *to a minimum* the gauge wear of the bits in abrasive rock. And owing to the ease with which the feed pressure is released and brought back into action, the Lion is a *handier* drill to work with in fissured rock.

Sandvik Coromant—the right steel for the Lion

All Atlas Copco drills—and this goes for the Lion—have been developed from the earliest stages with Sandvik Coromant tungsten-carbide-tipped integral steels and detachable bits. No drill or steel developed separately could ever give such equivalently high performances as this drilling combination. It is today the most widely used in the world, responsible for drilling more than one billion feet per year.

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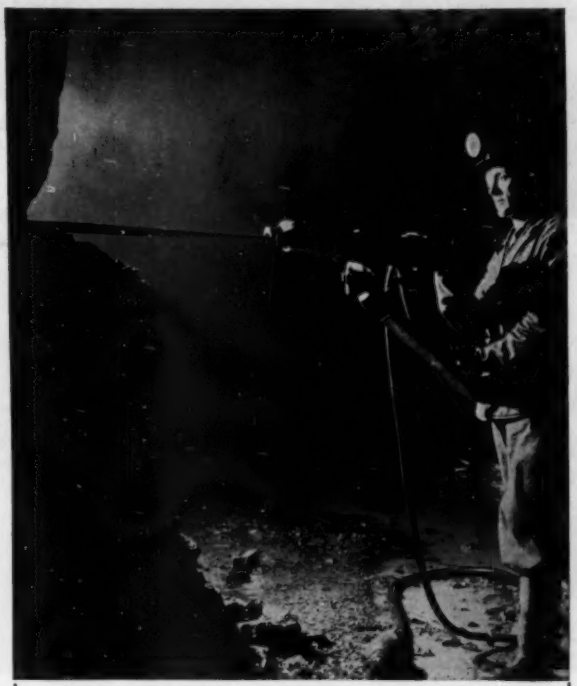

Without changing the grip of the hand the driller can easily position and control the machine, saving time and reducing fatigue.

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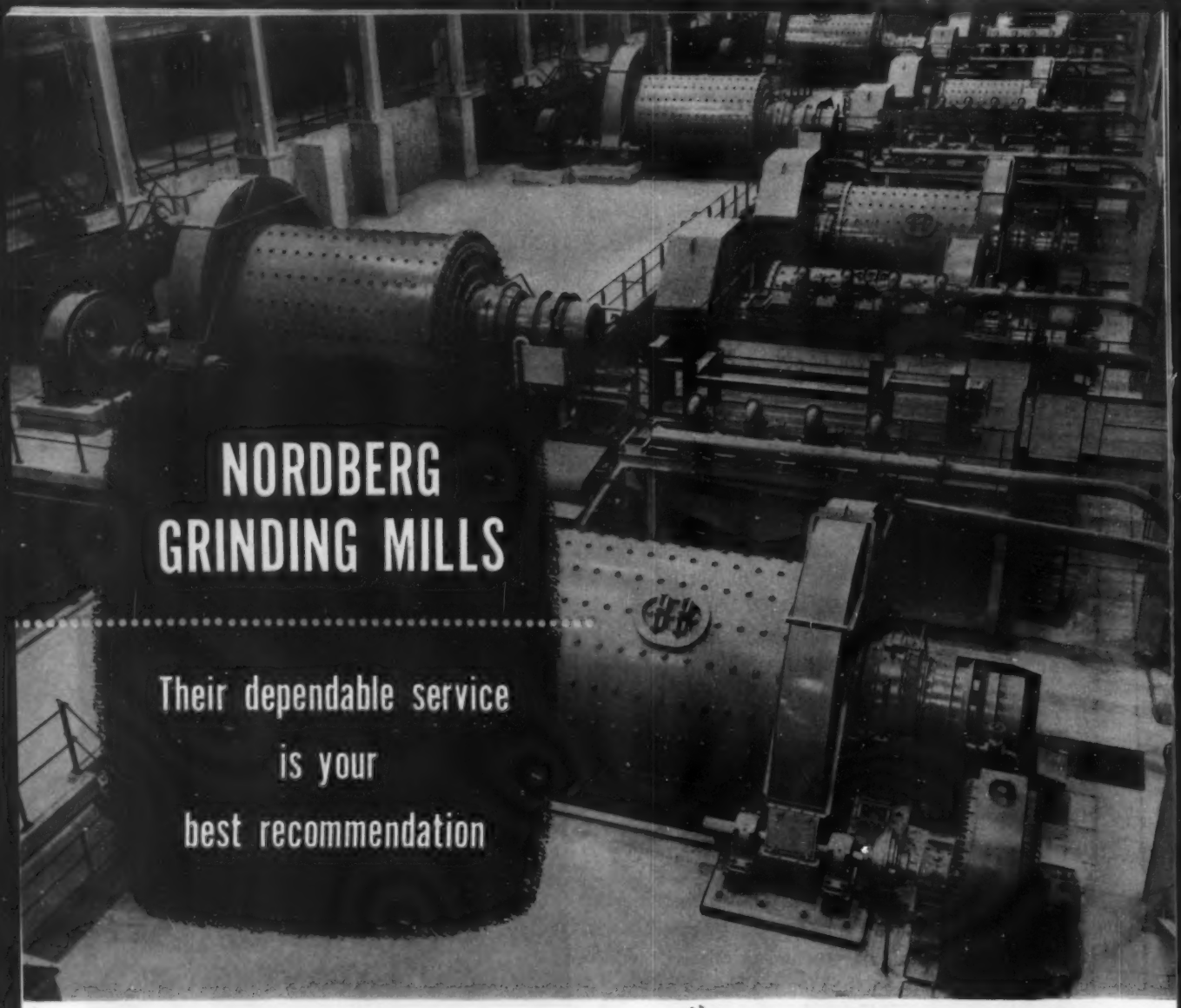

(Above): *Four Nordberg 10½'x16' Rod Mills and eight Nordberg 10½'x14' Ball Mills installed in a large concentrating plant for the reduction of hard, abrasive "Taconite" ore.*

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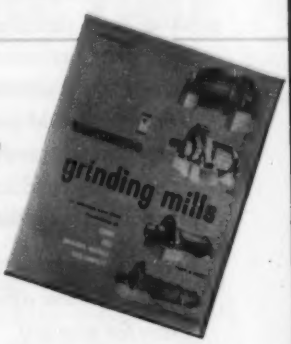

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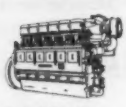

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Today the position of the American MARC-Hallett team is stronger than ever. Foreign competition in both quality and price is now met successfully by American MARC's modern mass-production techniques in the manufacture of rugged, reliable, truly All-American Diesel engines.

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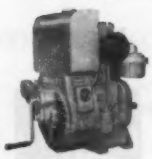
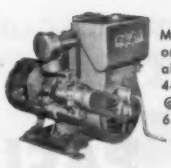
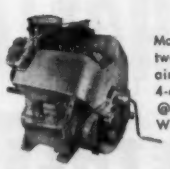


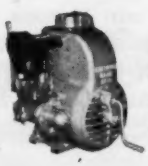
Model WC-1, one-cylinder, water-cooled, 4-cycle, 6 HP @ 1800 RPM. Wt.: 220 lbs.



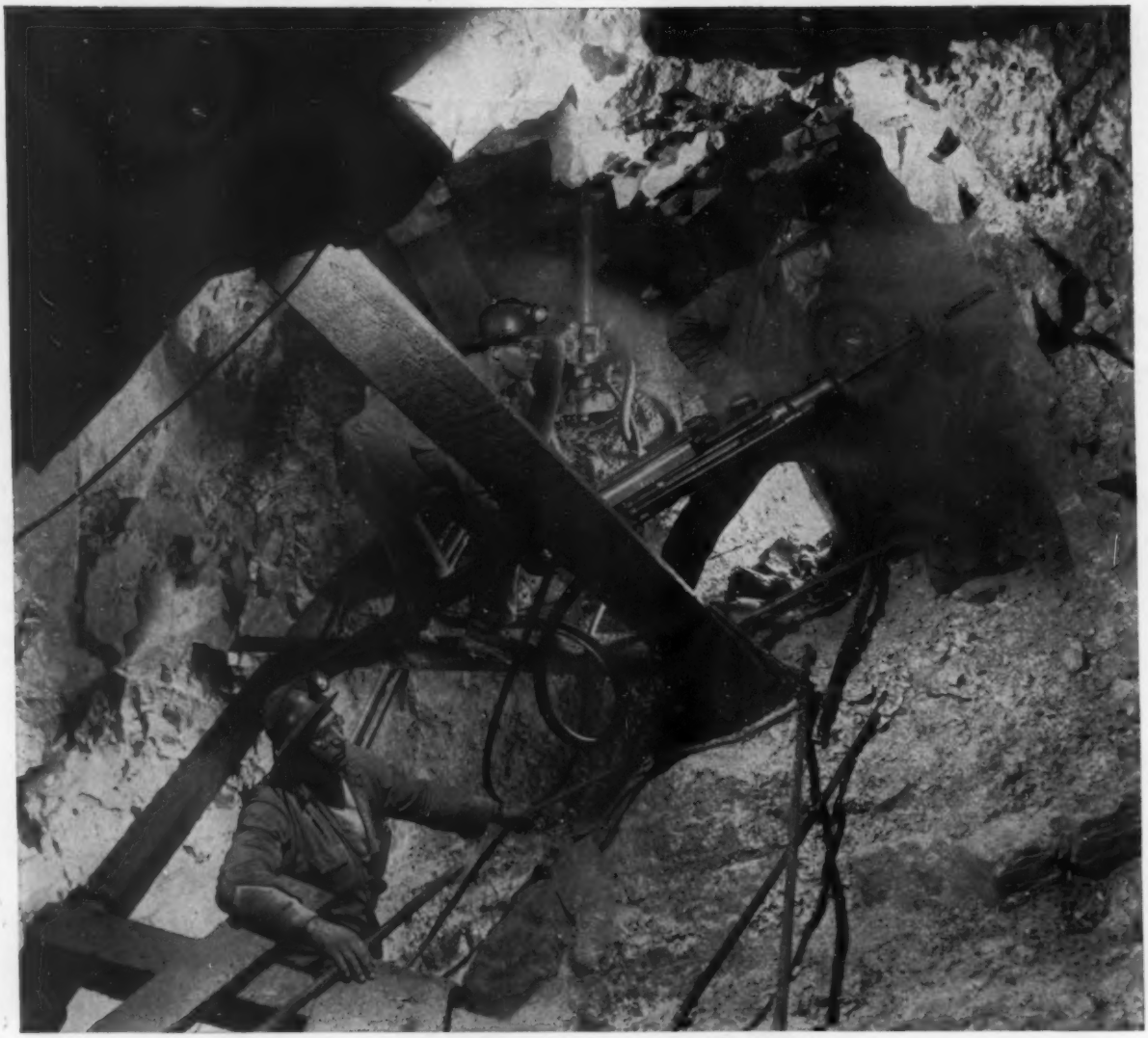
Model A1Q-3KW, one-cylinder, air-cooled, 4-cycle, 3KW @ 1800 RPM. 6-7 HP



Model AC-2, two-cylinder, air-cooled, 4-cycle, 14 HP @ 1800 RPM. Wt.: 350 lbs.



Model AC-1, one-cylinder, air-cooled, 4-cycle, 6 HP @ 1800 RPM. Wt.: 220 lbs.



Mining Molybdenum in the Colorado Rockies

Bartlett Mountain, on the Continental Divide near Climax, Colo., is one of the world's richest sources of molybdenum. The 13,863-ft giant is mined by Climax Molybdenum Company. Bethlehem Hollow Drill Steel is used extensively in making the blast holes.

Here molybdenum is produced as the primary product, with tungsten, tin and iron pyrite the by-products. The method used, called cave mining, consists of tunneling through granite beneath the ore body, then undercutting and caving so that the ore is converted into a mass of broken rock, which is removed much like gravel coming from a hopper.

The blast holes, ranging in depth from 8 ft to 35 ft, are made largely with Bethlehem Ultra-Alloy Drill Steel in hexagons, quarter-octagons and rounds, fitted with carbide-insert bits.

Bethlehem Hollow Drill Steel, whether Ultra-Alloy or Carbon, is just what you need for economical drilling because it is made of fatigue-resistant steel, and has a uniform, centrally located hole. Besides, it has a wide quenching range, and is easy to heat-treat for the proper balance of toughness and wear-resistance.

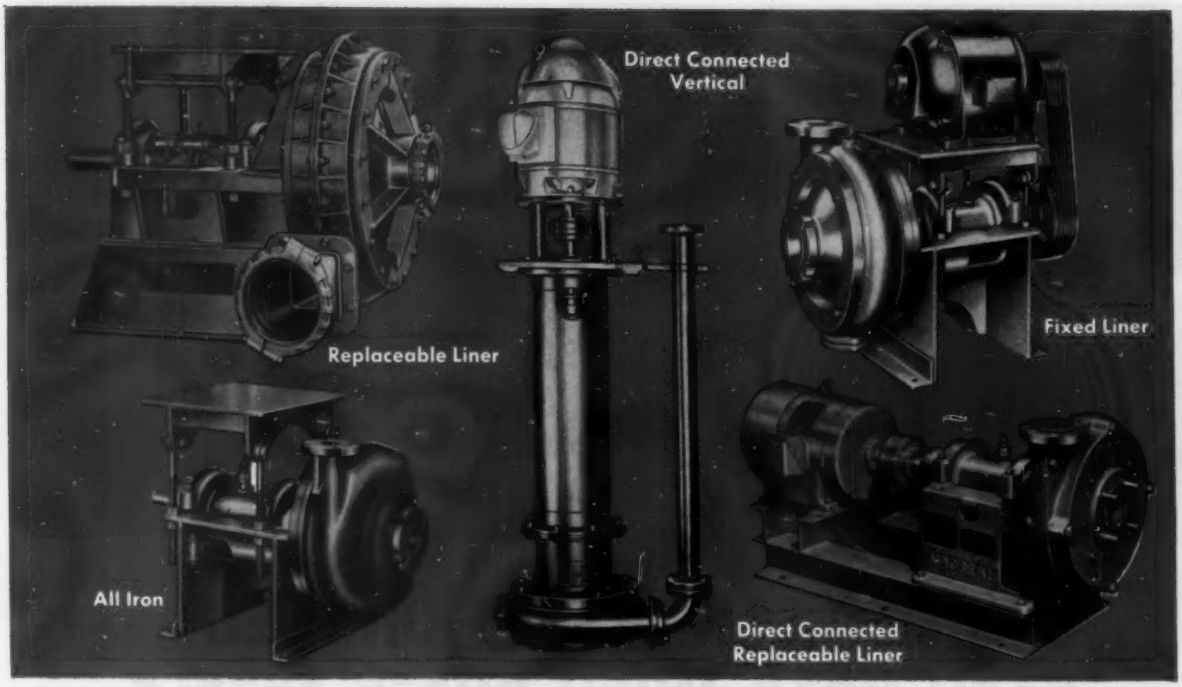
Leading distributors and converters throughout the West handle Bethlehem Hollow Drill Steel.

BETHLEHEM PACIFIC COAST STEEL CORPORATION

Sales Offices: Los Angeles, Phoenix, San Francisco, Portland, Seattle, Spokane

BETHLEHEM PACIFIC

BETHLEHEM STEEL



VERSATILE VACSEAL

Every VACSEAL Pump is engineered for its specialized job

Galigher has long been associated with International Combustion Ltd. of London, England in the manufacture of the world famous VACSEAL Pump . . . a pump that has gained wide acclaim for its principle of positive suction without the use of sealing water. Without modifying the original VACSEAL Impeller design, Galigher has greatly widened VACSEAL'S scope of application . . . making it a truly diversified pump with the use of replaceable liners, removable bearing assemblies and with the introduction of vertical models.

FIXED LINER — The standard VACSEAL pump for abrasive or corrosive service with natural or synthetic rubber linings engineered to suit actual conditions. Casings and other parts can be factory relined and re-coated.

REPLACEABLE LINER — For applications where extreme wear is encountered or where high freight rates make replacement of castings prohibitive, steel-reinforced, non-collapsible liners can be furnished.

ALL IRON OR ALLOY — For such applications as dredging, coarse sand, gravel, lime slurry and corrosive solutions requiring alloys.

VERTICAL — Special mountings for dry-pit and wet-pit service.

SIZE	CAPACITY
1½" x 2"	10 — 120 gpm
2" x 2½"	50 — 190 gpm
3" x 4"	150 — 500 gpm
4" x 6"	300 — 700 gpm
6" x 8"	500 — 1500 gpm
8" x 10"	800 — 3600 gpm

Through the cooperation of our staff of experienced mill operators, metallurgists and engineers we are able to help you in the selection of a pump installation to suit your needs. We welcome your inquiries.

Leaders in Experience and Service

THE GALIGHER CO.

METALLURGICAL DIVISION · GALIGHER COMPANY · ENGINEERING SERVICE

VPS13

HOME OFFICE: 545-585 W. 8th South
P. O. Box 209
Salt Lake City 10, Utah

EASTERN OFFICE: 921 Bergen Ave.
(Room 721)
Jersey City 6, New Jersey

CONSULTATION • ORE TESTING • PLANT DESIGN

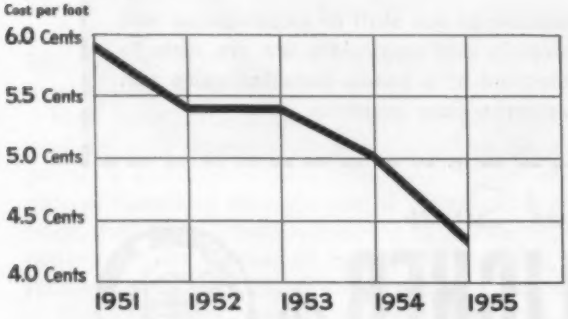
GALIGHER PRODUCTS: AGITAIR® Flotation Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Geary Reagent Feeder, Laboratory AGITAIR® Flotation Machine, Laboratory Pressure Filter, Laboratory Ball Mill, Rubber Lined and Covered Products, Plastic Fabrication.

ONE BILLION FEET DRILLED EACH YEAR WITH THESE STEELS

For many years Sandvik Coromant steels have been the world's most widely-used integral drill steels. And as each year passes, their share of the world rock-drilling market becomes even larger; responsible for drilling more than one billion feet annually. The reason behind this ever-increasing demand is their consistently high and uniform quality.

Meticulous production control

Sandvik control every phase of production, from the mining of iron ore and processing of the wolfram ore, to the final tungsten-carbide-tipped drill steels. This 'under-one-roof' policy of Sandvik has produced steels of a quality that is always improving; steels that have brought *faster* speeds and *new* economies to drilling. The production of Sandvik Coromant steels is not only strictly controlled, but also influenced by valuable information gained from extensive research. Every year, with the close co-operation of Atlas Copco, hundreds of miles of test drilling is carried out both in Sandvik's own test mine and under actual working conditions.



Increased quality brings lower drilling costs

Since the introduction of Sandvik Coromant steels some ten years ago, their quality and life has been continually increased. A longer life means *lower* drilling costs. For example, take the costs of a well-known Canadian mine shown in the graph. You'll notice that the cost per foot with Sandvik Coromant steels has decreased by 25% in just four years!

World's leading drilling unit

Sandvik Coromant drill steels are another step towards lower drilling costs. And when fitted to an Atlas Copco rock drill you have an unbeatable drilling unit, for both were developed to work together. *No drill or steel developed separately could ever give such equivalently high performances.* Atlas Copco drills and Sandvik Coromant steels have become the world's leading drilling unit, a combination that has turned mining and tunnelling—in just one decade—into a smooth and highly-efficient operation.

SANDVIK COROMANT integral steels, detachable bits and long-hole equipment are supplied in ninety countries throughout the world by Atlas Copco, who, in their own field, are the world's largest manufacturers of rock drills. Contact any of these offices *today* for further information and a demonstration.

U.S. Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California. Atlas Copco Eastern, Inc., P.O. Box 2568, Patterson 25, N.J.

CANADA Atlas Copco Canada Ltd., Montreal Airport, P.Q.

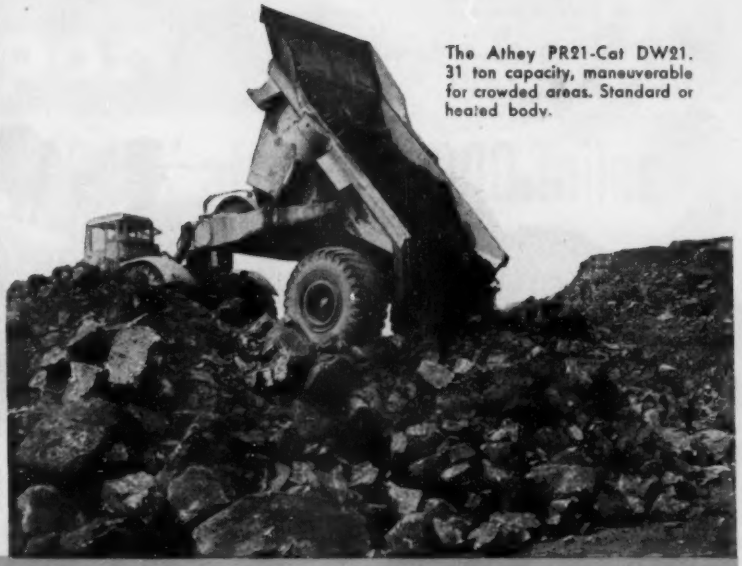
MEXICO Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.

Atlas Copco

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

The Athey PR20-Cat DW20. Capacity 22.5 cu. yds. Speeds up to 32.1 MPH for high-speed hauling.

The Athey PR15-Cat DW15. Hauls 22 tons of rock or other material at speeds to 31.3 MPH.



The Athey PR21-Cat DW21. 31 ton capacity, maneuverable for crowded areas. Standard or heated body.

ATHEY OFFERS YOU

the only COMPLETE and PROVED Trailer Line

The new Athey Hydraulic Ejection Trailer. Handles sticky, hard-to-discharge materials, controls dumping, spreads load at dump.

The Athey PD20-Cat DW20. Dumps on the go, speeds long haul jobs, capacity 31 tons at speeds up to 25.1 MPH.

For tough rock and earth jobs...

Whether it's big rock — gumbo clay — ore, mud or earth you have to move, there's an Athey Trailer to answer your material hauling problems. Athey is the leader in the trailer field and offers the only *complete* line of sizes and types of high-speed material handling trailers.

Each unit is built to rigid standards of quality construction that mean long life and low upkeep. Proven Athey design features are setting the pace for faster dumping, greater maneuverability, easier loading and higher production.

Select the exact size and features to gear your job for highest output. Depend on quality-built Athey Trailers powered by Caterpillar Wheel-Type Tractors. Ask your Athey-Caterpillar Dealer for information on "the complete line" today, or write direct to us. Athey Products Corporation, 5631 West 65th Street, Chicago 38, Illinois.

Athey

THE *Complete* TRAILER LINE... *by the Leader*

STRIP AND RECLAIM ECONOMICALLY *with help like this . . .*

- **MOST POWER PER YARD . . . most power per pound in its class**
- **MOVES FULL LOADS AT FULL SPEED**
- **WIDE OVERLAP IN GEAR RANGES . . . for easy shifting, smooth acceleration**
- **CURVED BOWL BOTTOM . . . offset cutting edge . . . for fast, full loading**
- **HIGH APRON LIFT . . . positive, clean ejection**

This is the Allis-Chalmers TS-360 . . . a motor scraper that has proved it can strip overburden profitably . . . and reclaim worked-out areas in the same operation. As demands for greater efficiency increase, be ready with the best . . . an Allis-Chalmers TS-360. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

The Engineer's Field Report

CASE HISTORY
LUBRICANT RPM Delo Oils
FIRM Arizona Sand & Rock Co., Phoenix, Arizona

Sleeve taper only .0045" after 150,000 miles hauling under tough conditions

This Mack tractor's 200 h.p. Cummins diesel went in for its first overhaul after four years hauling heavy equipment to and from Arizona construction jobs. The rig hauls loads up to 25½ tons in on-and off-highway work. Using RPM DELO Special Lubricating Oil since new, inspection after 150,000 miles showed oil return holes clear, all rings free and in good condition, maximum sleeve taper only .0045". Manley Johnston, Shop Foreman, Arizona Sand & Rock Co., reported, "The engine was really clean! It could have gone at least 50,000 more miles."

Arizona Sand & Rock, general contractors for road building projects and operators of a large plant, works its equipment in constant dust and grit...in desert and mountainous terrain. The company depends on RPM DELO Oils to give the protection these heavy-duty engines need under these tough conditions.

RPM DELO LUBRICATING OILS

TRADEMARK "RPM DELO" REG. U. S. PAT. OFF

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your nearest distributor, write or call any of the companies listed below.

Why RPM DELO Oils reduce wear in heavy-duty engines

Detergent keeps parts clean...helps prevent piston scuffing. Special compounds stop corrosion of any bearing metal and foaming in crankcase.

Special additives provide metal-adhesion qualities...protect parts hot or cold, running or idle.

Anti-oxidant resists lacquer formation...prevents ring sticking.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

Big production: at the Camp Dennison, Ohio, plant, a 2¼-yd. Michigan loads out a heaping bucket load of frozen aggregate. Power-shift transmission is standard equipment—cuts seconds off every cycle between truck and pile.

$76,000* buys *one* 2¼-yd. truck crane or *four* 2¼-yd. Michigan Tractor Shovels . . .

Here's why Ohio Gravel Co. bought the four Michigans

Ohio Gravel Company operates five plants around the perimeter of Cincinnati. Until a short time ago, ½-yd. and ¾-yd. clamshells and shovels handled all loading from stockpiles. When it became apparent that the Miami plant (300 t.p.h. capacity) did not have adequate loading capacity, Ohio Gravel asked for bids on a special 2¼-yd. mobile crane. According to Walter Flach, V. P. Production, they recognized the need for bigger bucket capacity and better mobility between stockpiles. Bids on the crane ran from $65,000 to $76,000—a substantial price to pay for increased capacity in *only one of the five plants.*

Had to leave the demonstrator

At this point Bode-Finn Co., the local Michigan distributor, got permission to demonstrate a 2¼-yd. Michigan Tractor Shovel at the Miami plant. The "demonstration" lasted two weeks—that is, Ralph Hautman (Miami superintendent) wouldn't

*Current list price F.O.B. factory for four 2¼-yd. diesel Michigan Tractor Shovels.

let them take the demonstrator away until a permanent machine was delivered. Before the new Michigan even arrived, Ohio Gravel Company bought three more for other plants. *The total cost of the four Michigans was approximately the same as the one crane.*

Loads as much as two cranes

At the four plants with Michigans, the superintendents agree that one Michigan loads trucks as fast or faster than two ¾-yd. clamshells. With widely separated stockpiles, the Michigans move around the yards as fast as the incoming trucks—27 mph top speed. They consistently get heaping bucket-loads. Power-shifted cycles between pile and truck average about 40 seconds; it takes 4 minutes or 6 bucket-loads to put 19 tons into a dump trailer (see picture).

A typical heaping bucket-load of graded bank run comes up well over the 2¼-yd. rated bucket capacity. Digging bank run, the Michigan handles approximately 5½ tons per bucket-load.

Handling clean-up work in its spare time, the Michigan eliminates stockpile contamination. Unlike the clamshells which formerly handled the job, the Michigan does not pick up dirt as it cleans up around the piles.

More profits for producer and trucker

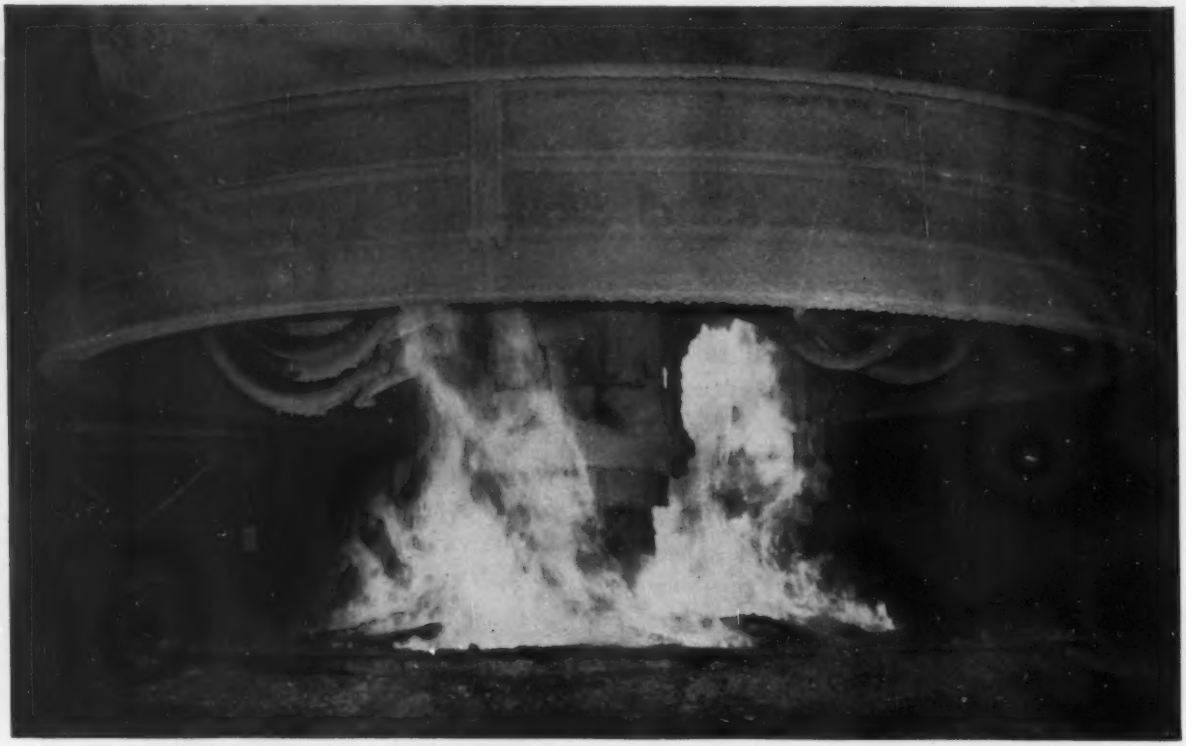
Faster travel, faster cycles, bigger bucket-loads obviously make more profits for producer and trucker alike. Ohio Gravel Company recognized this fact when the first Michigan was demonstrated. Your own Michigan distributor will give you this same kind of proof. A chance to demonstrate is all he asks—*you name the job.*

Michigan is a registered trade mark of

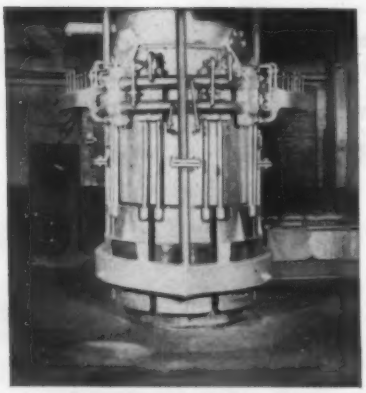
CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2493 Pipestone Road
Benton Harbor 18, Michigan

It took four minutes to put 19 tons of material into this dump trailer. Six bucket loads filled it. Note that the 2¼-yd. Michigan has plenty of dumping clearance over the 10-ft. high side boards. Even with batch boards in place, the Michigan has no trouble.



After two years of slipping-under-load, no replacements of contact shoes and clamps!



40-inch Lectromelt self-baking electrode clamp assembled on our erection floor for testing.

Load has been boosted 40% above the original rating

LECTROMELT electrode holders have turned in a remarkable performance on a 9,000 KVA ferrosilicon furnace on the West Coast. The furnace was down recently for slight alterations, so the engineers were able to examine these holders carefully.

Electrodes are slipped under load. Since that load has been boosted 40% above the original design rating, severe demands are placed on contact shoes and clamps. Even so, no replacements were required after two years of intensive service. These Lectromelt shoes and clamps went back into service when the furnace was started up.

This ability of Lectromelt furnace equipment to meet exacting service requirements accounts for its popularity all over the world. For a copy of Catalog 105, write Lectromelt Furnace Company, 324 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

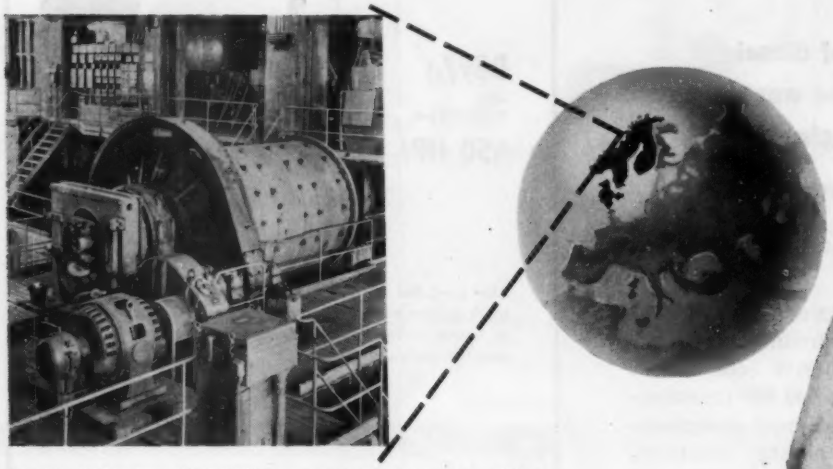
Manufactured in . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa . . . JAPAN: Daido Steel Co., Ltd., Nagova

*REG. T. M. U. S. PAT. OFF.

WHEN YOU MELT... *Lectromelt*

I saw them in Scandinavia, too!

YES, WHEREVER THERE'S MINING, you'll find the successful companies using *Marcy Mills.* The fact that these companies throughout the world continue *reordering* Marcys is evidence of Marcy's low-cost-per-ton production and dependable mechanical operation.



An 8' x 12' Marcy Rod Mill on copper-lead-zinc ore at the A. B. Zinkgruvor mill in Garpenberg, Sweden. This mill is just one of approximately 35 Marcys made by Mine and Smelter's licensed manufacturer and sales representative in Scandinavia, Morgardshammars Mekaniska Verkstad, Morgardshammar, Sweden... a company with an international reputation in the mining industry for over 100 years.

One Reason...*proper design and the best worldwide manufacturing facilities.*

For more than 40 years Mine & Smelter has specialized in the design and manufacture of grinding mills. This *experience* has resulted in a selection of materials and a type of construction which assure long, trouble-free operating service, minimum maintenance, and maximum convenience in installing, aligning, and operating the mill.

It is equally important to you to have available good manufacturing and service facilities, as provided by our U.S. plant . . . and our foreign manufacturers and representatives, who are experienced mining people backed by excellent shop facilities. You can depend on them to do a good job.

NO EXTRA CHARGE FOR MARCY® EXPERIENCE

THE MINE AND SMELTER SUPPLY CO.

DENVER NEW YORK SALT LAKE CITY EL PASO

Licensed Manufacturers and Sales Representatives:

Canadian Vickers, Ltd., Montreal, Canada

The Austral Otis Eng. Co., Ltd., So. Melbourne, Austr.

Morgardshammars Mek. Verkstads Aktiebolag, Morgardshammar, Sweden

Pegson Limited Coalville, Leicestershire, England

Sales Representatives:

Andrews and George Co., Inc., 5 Shiba Park, Tokyo, Japan

W. R. Judson, Santiago, Chile

The Edward J. Nell Co., Manilla, P. I.

The Ore & Chemical Corporation, 80 Broad Street, (Representatives for Continental Europe) New York City 4, New York

Continental Sales and Equipment Co., Hibbing, Minnesota

Mines Engineering and Equipment Co., San Francisco, Calif.

MODERN HEAVY-DUTY CAT* FOR EVERY JOB

From a quarter century of diesel leadership, now comes the world's most advanced line of diesel engines.

Developed by Caterpillar research, these compact units pack more power in less space and deliver greater efficiency, greater economy and longer life in any application.

You have your choice of hundreds of variations in engines up to 650 HP (maximum output capacity), electric sets up to 350 KW (continuous duty) and marine engines up to 500 HP (continuous duty). They're available as original or replacement power for excavators, hoists, crushers, electric power, pumps, boats, loggers, sawmills and other equipment.

Why they do a better job than ever

These modern heavy-duty diesels feature the four-cycle design which provides a smooth, effective power stroke and a more efficient utilization of power. They require practically no attention. Their fuel system requires no adjusting. And Caterpillar's single-orifice fuel injection valves with the precombustion chambers permit the use of such low-cost fuels as No. 2 furnace oil without fouling. All these and other features add up to new standards of performance in diesel power.

A quarter century of diesel leadership

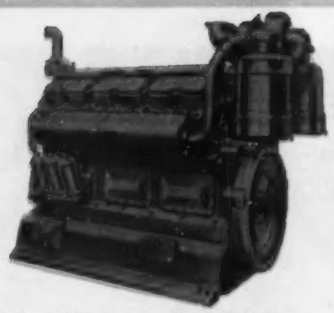
For modern power that stems from a quarter century of diesel leadership, specify Caterpillar units. Leading manufacturers can supply them in the equipment they build.

For complete information about them, see your Caterpillar Dealer. He backs you with prompt service. He has the experience and technical knowledge to help you with your power problems.

Caterpillar Tractor Co., San Francisco, Cal.; Peoria, Ill., U.S.A.

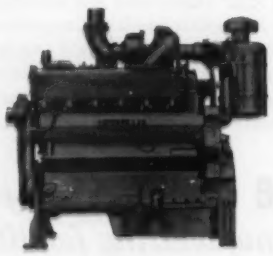
HUNDREDS OF DIFFERENT UNITS TO MEET YOUR POWER NEEDS

D397
with
Turbocharger
650 HP†



Also available as a Roots blown, naturally aspirated or spark-ignition engine — and as an electric set, marine engine or torque converter power unit. Choice of air, electric or gasoline starting system.

D337
with
Turbocharger
310 HP†



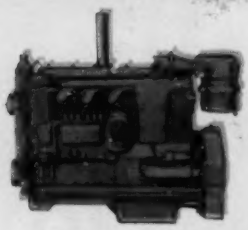
Also available as an electric set, marine engine or torque converter power unit. Choice of air, electric or gasoline starting system.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

DIESELS

NEW D318
(Series G)
Turbocharged
175 HP†

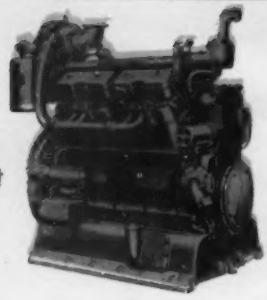


NEW D315
(Series G)
Turbocharged
115 HP†

SMALLER, LIGHTER AND LOWER PRICED!

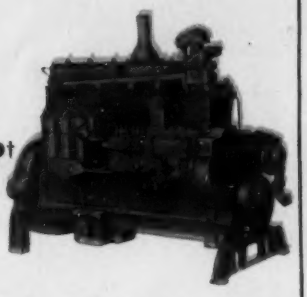
Keeping in line with Caterpillar's continued diesel leadership are these new Series G engines. They are designed for use in installations where space is at a premium. Both are small, light and low-priced; yet they deliver dependable power with the renowned Caterpillar durability. They are available naturally aspirated (above) or turbocharged. Choice of air or electric starting system.

D375
with Turbocharger
430 HP†



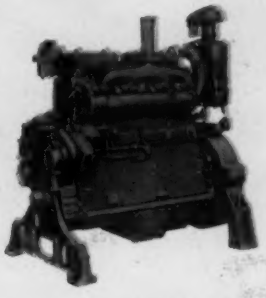
Also available as a Roots blown, naturally aspirated or spark-ignition engine — and as an electric set, marine engine or torque converter power unit. Choice of air, electric or gasoline starting system.

D342
Naturally Aspirated
210 HP†



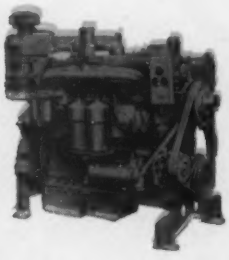
Also available as an electric set or marine engine. Choice of air, electric or gasoline starting system.

D339
Naturally Aspirated
140 HP†



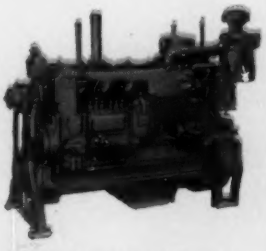
Choice of air, electric or gasoline starting system.

D326
Naturally Aspirated
200 HP†



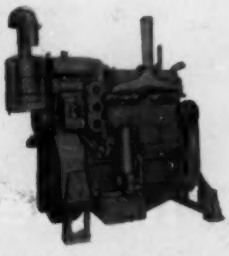
Also available as an electric set, marine engine or torque converter power unit. Choice of air, electric or gasoline starting system.

D318
Naturally Aspirated
137 HP†



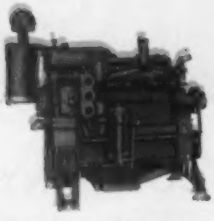
Also available as an electric set, marine engine or torque converter power unit. Choice of air, electric or gasoline starting system.

D315
Naturally Aspirated
91 HP†

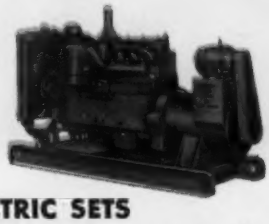


Also available as an electric set, marine engine or torque converter power unit. Choice of air, electric or gasoline starting system.

D311
Naturally Aspirated
65 HP†

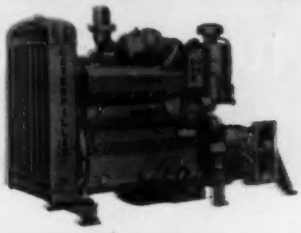


Also available as an electric set. Choice of air, electric or gasoline starting system.



ELECTRIC SETS

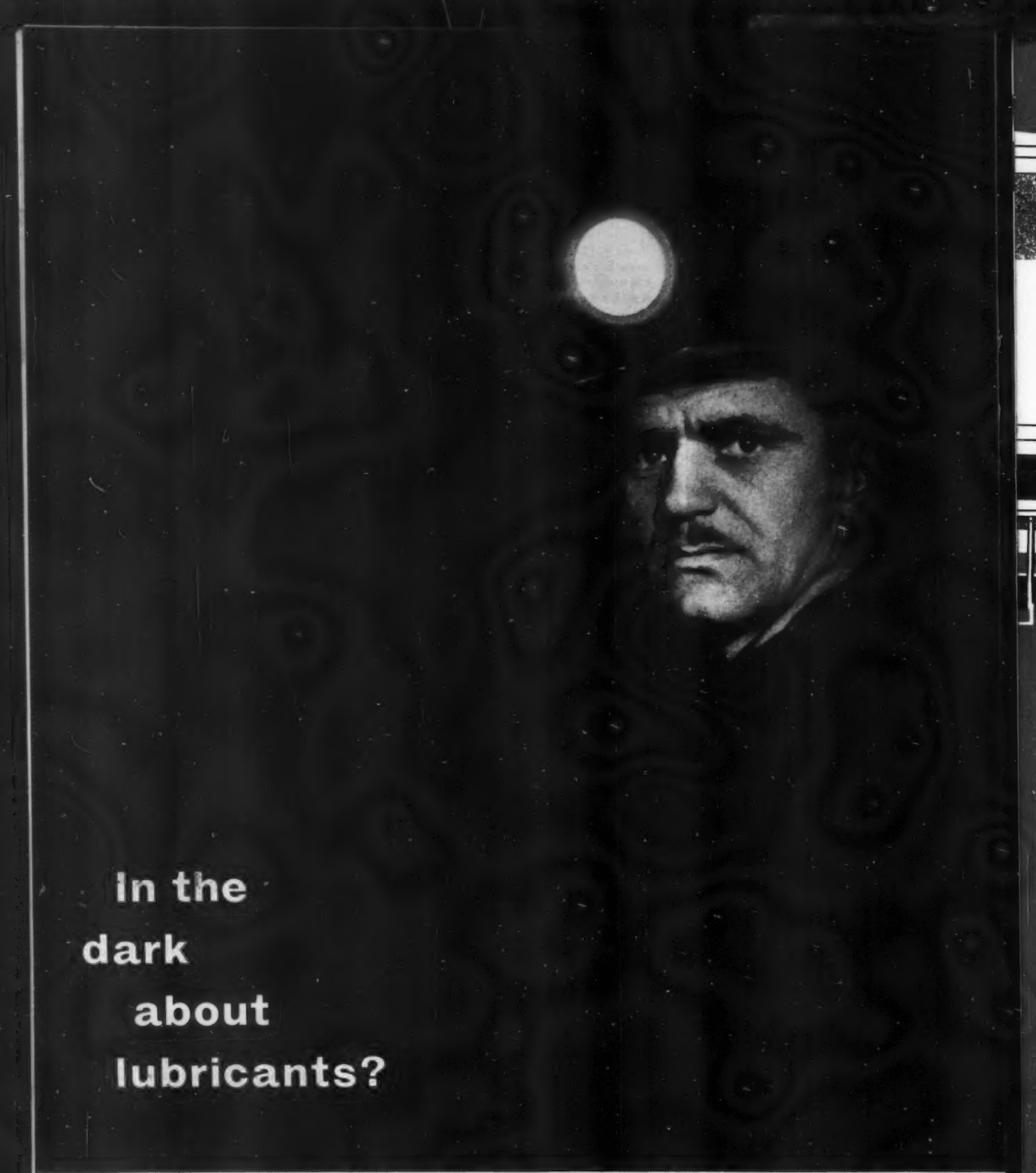
Dependable electric power, featuring the new Cat Generator, is available in standard voltages, 60-cycle, in the following KW sizes: 30, 40, 60, 100, 150, 165, 200, 225, 250, 315, 350. Also available as 50-cycle and DC units. The new generator brings you the best features of self-regulated and externally-regulated generators in one compact package.



TORQUE CONVERTER POWER UNITS

Many different arrangements are available for each of six Caterpillar Engines to provide you with a greater selection of power packages. You have a wide choice of power units and a wide choice of output shafts.

†maximum output capacity



Call in a Union Oil lubrication engineer. His wide experience with specialized lubricants for mining equipment, above and below ground, will undoubtedly help shed light on your lubrication problems, no matter how obscure.

UNION OIL COMPANY 76
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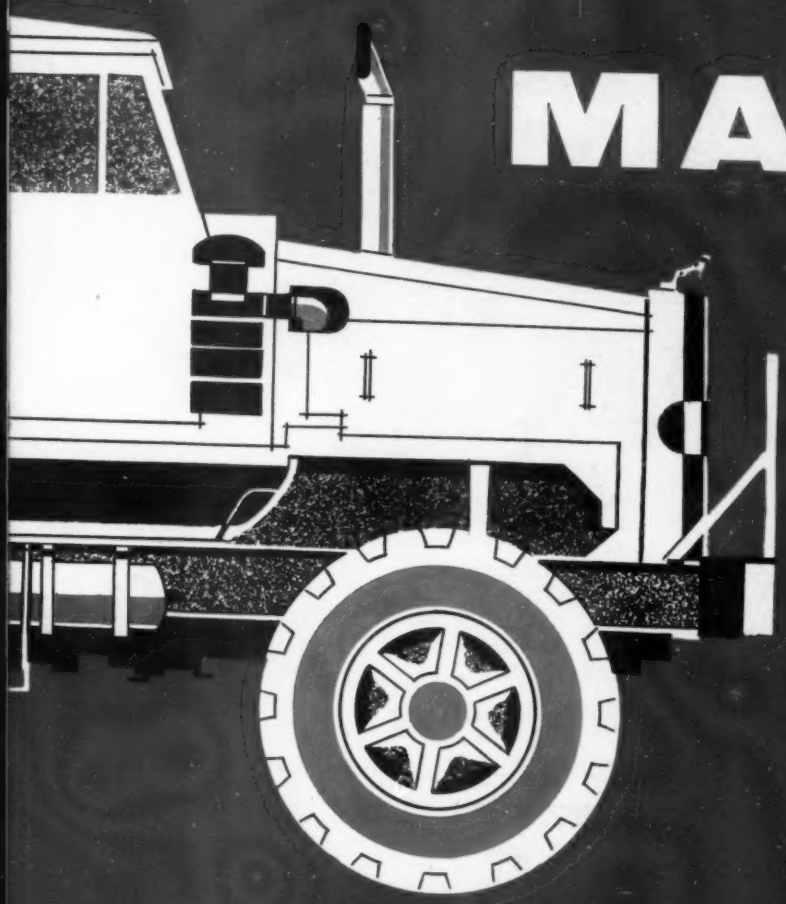
Los Angeles: *Union Oil Bldg.* • ***New York:*** *45 Rockefeller Plaza* • ***Chicago:*** *1612 Bankers Bldg.* • ***Philadelphia:*** *Eastwick Ave. & Edgewood St.* ***Dallas:*** *313 Fidelity Union Life Bldg.* • ***Kansas City, Mo.:*** *612 W. 47th St.* ***New Orleans:*** *644 Nat'l Bank of Commerce Bldg.* • ***Boston:*** *214 Harvard Ave.*



NEW MACK

heavy-duty four- and six-wheel dumpers

15- to 34-ton capacity

* LARGEST SELECTION OF HEAVY DUMPERS

Mack offers you the most complete line of dumpers for mining, quarrying, road building, construction. From heavy-duty 170 horsepower, four-wheel dumpers with 15-ton capacities to super-duty 400-horsepower, six-wheel dumpers with 34-ton capacities, Mack provides the economy and performance that can mean bigger hauling profits for you.

* CHOICE OF ENGINES

Mack offers you a choice of engines . . . Cummins diesels in the 300- and 400-horsepower class . . . or Mack Thermodyne and Cummins diesels in the 170 to 205 horsepower class. No need to alter existing maintenance facilities to handle new engine makes . . . you get the truck you want with the engine you want.

* OUTSTANDING PERFORMANCE

When you buy Macks, you know that you are getting top performance, outstanding economy, maximum dependability—qualities that have made Mack the acknowledged heavy-duty truck leader in the industry. Moreover, Mack dumpers are planned for accessibility throughout . . . engines are easily reached, no place in the suspension ever needs adjustment—these and many more Mack features reduce maintenance costs and make routine servicing easier. And in Macks, you get the finest transmissions and axles available . . . made by Mack and found only in Macks!

* COMPETITIVELY PRICED

Mack off-highway dumpers are priced right in line with competitive makes. Yet, with Macks, you get those "extras" that mean more payloads at lower hauling costs . . . cabs engineered for maximum driver efficiency . . . specially designed components with extensive use of heat-treated alloy steels . . . single-unit all-welded frames that can take plenty of hard knocks . . . outstanding performance and economy from a complete line of engines.

* STOCK DELIVERY

All 15 and 22½-ton Mack dumpers are available from stock. The units you want with the engines and transmissions you want can be supplied upon gratifyingly short notice. There are no delays, no production schedules for you to worry about. For more information on delivery, contact your local Mack Dealer or Representative.

MACK LRX

capacity: 15 tons

This four-wheel, off-highway dumper combines a big 15-ton rated capacity with outstanding maneuverability. Either a Mack or Cummins diesel engine of the 200-horsepower class—along with heavy-duty clutch, 10-speed transmission, and Mack's Planidrive rear axle assembly—gives plenty of pulling power for long hauls on steep grades. Rugged, unified frame assembly, powerful air brakes, and comfortable cab with driver's position offset to the left assure the top performance and efficiency that have made the LRX a highly popular dumper in mine, quarry, and road-building operations.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:	14.00-24 Rear Tire
Wheel Base	12′ 6″
Platform	9′ 1″
Overall Width	10′ 9½″
Overall Height	10′ 5″
Overall Height (Body Raised)	18′ 8″
Overall Length	24′ 7½″
Turning Circle Diam. (To outside edge of tire)	60′
Weight (Chassis, Body & Hoist)	33,000 lbs.
Payload	30,000 lbs.

ENGINE (Diesel):

Model	END 673
Make	Mack, Thermodyne
Type	Naturally aspirated
Number of cylinders	Six
Bore and stroke	4⅛″ x 6″
Piston displacement, cu. in.	672
Brake horsepower @ 2100 r.p.m. (gov.)	170
Max. torque @ 1200 r.p.m.	480 lb.-ft.

CLUTCH (Available with END 673 only):

Type	Mack single-plate, dry
Area of engagement, sq. in.	253

ELECTRICAL SYSTEM:

Voltage and capacity . 12 V., 50 Amp. (24 V., Starting)

TRANSMISSION:

Type	Mack selective, constant mesh
No. of speeds, forward	Nine
reverse	Two

FRONT AXLE:

Make . Mack Reversed-Elliott, dropped forged I-beam

REAR AXLE:

Make	Mack Planidrive
Drive	Dual Reduction
Final Drive (3rd reduction)	Planetary gear train within wheel hubs
Total Ratio	16.5

BRAKES (Air):

Compressor	Tu-Flo
Type	Internal expanding
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	12″ x 5″ x ⅜″, Bendix

FRAME:

Side-members, size	12½″ x 6¾″ x ½″, wide flange I-beam, rolled section
Section modulus	60.7 (per rail)

SPRINGS:

Front, type	Semi-elliptic
Rear, suspension	Semi-rigid, axle saddle mounted to frame

WHEELS:

Type . . . . . Cast, spoke

STEERING GEAR:

Control . . . . . Manual

TIRES:	Front	Rear
Size	12.00-24 (16P) Rib	14.00-24 (20P) Lug

CAB:

Type: Heavy-duty off-highway, closed, all-steel welded. Offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Front and rear tow pins; air horn on cab roof; cab entrance steps and platforms; rear view mirror, left side; channel type front bumper; dual windshield wipers; stop-tail light; rim lug wrench and handle.

HOIST:

Make & model . . . . . Heil
Type-Twin, double-acting, 8″ diameter, hydraulic cylinders with 24″ stroke, 70° dumping angle.

BODY:

Type	Rock, with scoop end
Make	Heil
Capacity, line of plate	9.8 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 5 lb. channels between floor plates either side of a 1⅜″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE (Diesel):

Model	NHB	ENDT 673
Make	Cummins	Mack, Thermodyne
Type	Naturally aspirated	Turbocharged
Number of cylinders	Six	Six
Bore and stroke	5½″ x 6″	4⅛″ x 6″
Piston displacement cu. in.	743	672
Brake horsepower @ 2100 r.p.m. (gov.)	200	205
Max. torque @ r.p.m.	1200	1400-1600
pound-feet	537	560

CLUTCH (Included with NHB and ENDT 673):

Type	Mack two-plate, dry
Area of engagement, sq. in.	416

TIRES:	Front	Rear
Size	13.00-24 (18P) Rib	16.00-25 (20P) Lug

BODY:

Type	Flared Quarry
Make	Heil
Capacity, line of plate	11 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ½″ sides; ⅜″ header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 5 lb. channels between floor plates either side of a 1⅜″ edge-grain hardwood middle section filler.

Exhaust Heating: Provisions for exhaust heating of dump body available.

Body Equipment: (for std. and opt. bodies): (9) ⅜″ x 6″ alloy wear bars; rock ejectors; ½″ alloy wear plate; welded-on side boards (for std. body only).

CHASSIS EQUIPMENT: Automatic radiator shutters; Wagner "BB" (24 hour chart 0-3500 r.p.m.) tachograph, in place of standard tachometer; speedometer; hubodometer, left front wheel; Vickers power steering; front wheel limiting valve; hand control valve to operate rear service brakes; low air pressure indicator, Wig-Wag type; radiator guard; 25,000 B.T.U. hot water cab heater with defrosters; spare rim; hydraulic jack, 20-ton; air starting.

MACK LRSW

capacity: 30 tons

Powered by a 300-horsepower engine, this 30-ton, six-wheel dumper has what it takes for off-highway operation in mines, quarries and earth-moving projects. Smooth application of power to its balanced, four-wheel drive bogie is obtained by an air-assisted clutch and overgear transmission with two-speed compound or torque converter. Convenient location of controls, angle steering column, hydraulic steering booster, and extreme left driver position give easy and efficient handling. Best materials, precision manufacture, and specially engineered components make the LRSW capable of withstanding the toughest 'round-the-clock hauling.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	16′ 10″
Platform	14′ 11½″
Overall Width	11′ 1⅝″
Overall Height	11′ 5⅜″
Overall Length	29′ 4″
Overall Height (Body Raised)	24′ 10″
Turning Circle Diam. (To outside edge of tire)	78′
Weight (chassis, body & hoist)	60,000 lbs.
Payload	60,000 lbs.

ENGINE (Diesel):

Model	NHRBIS
Make	Cummins
Type	Supercharged
Number of cylinders	6
Bore and stroke	5½″ x 6″
Piston displacement, cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	300
Max. torque @ 1500 r.p.m.	818 lb.-ft.

CLUTCH:

Type	Mack two-plate, dry
Area of engagement, sq. in.	416
Actuation	Manual, with air assist

ELECTRICAL SYSTEM:

Voltage and capacity	12 V., 50 Amp. with 24 V., starting

TRANSMISSION:

Type	Mack two-lever, Duplex
No. of speeds, forward	Eight
reverse	Two

FRONT AXLE:

Type . . . . Mack Reversed-Elliott, drop forged I-beam

BOGIE:

Make	Mack Planidrive
Final drive, type	Four-wheel, planetary
Inter-axle differential, type	Mack concentric cam and plunger Power Divider
Carriers	Mack Dual Reduction
Total Ratio	18.18

BRAKES:

Type and actuation	Internal expanding, inclosed, air
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	16″ x 3″ x ¼″, four-shoe, disc

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	13 ⅛″ x 8″ with ⅝″ web and top flange, ⅞″ bottom flange
Section modulus	84.5 per rail

SPRINGS:

Type, front	Semi-elliptic
rear	Semi-elliptic, inverted
Suspension, Mack	Rubber Shock Insulators

SHOCK ABSORBERS, FRONT:

Type . . . . Houdaille, hydraulic

TIRES (Lug):	**Front**	**Rear**
Size	14.00-24 (20P)	16.00-25 (20P)

WHEELS . . . . Cast, spoke

STEERING GEAR:

Power steering assist . . . Vickers hydraulic booster

CAB:

Type . . Heavy-duty off-highway, closed, all-steel, welded. Offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Hubodometer; screen type radiator guard; front and rear tow pins; air horn; rear view mirror, left side; exhaust through hood with in-line muffler; channel type front bumper; door in hood side for access to oil filler and dip stick; insulating dash mat; wig-wag low air pressure indicator; windshield wipers; stop and tail light; back up light; rim lug wrench and handle.

HOIST:

Make . . . . Heil

Type—Twin, double-acting, 10″ diameter, hydraulic cylinders with 40″ stroke, 70° dumping angle with power return.

BODY:

Make and type	Heil, Rock-scoop end
Capacity, line of plate	21 cu. yds.

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE:

Make and model	Cummins, NRTO
Number of cylinders	Six
Bore and stroke	5½″ x 6″
Piston Displacement cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	335
Max. torque @ 1500 r.p.m.	900 lb.-ft.
Turbocharger	Turbine, exhaust driven

TRANSMISSIONS:

Westinghouse Converter and Mack 4-Speed Transmission. Clutch—2-plate, 17″.

Allison Torqmatic Converter and Allison Transmission

WHEELS, TIRES:

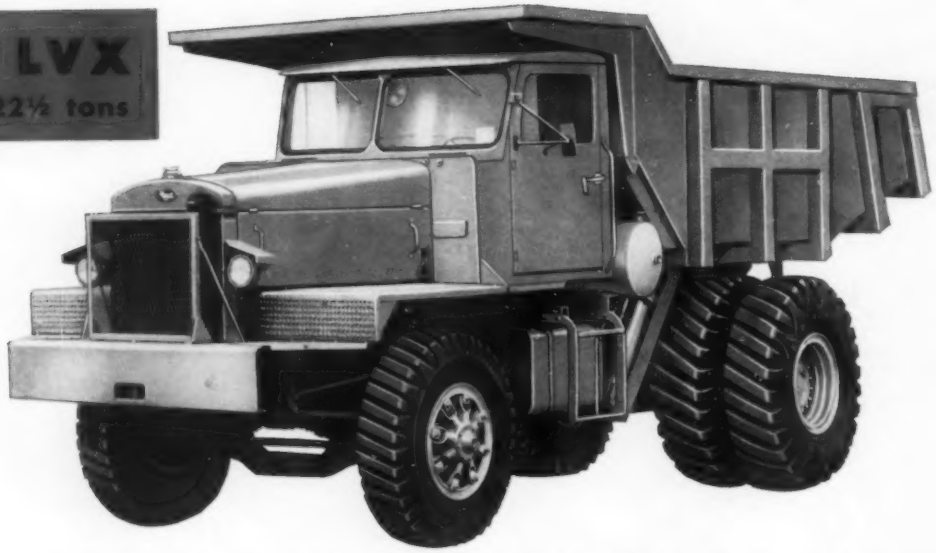
Front & rear Wheels, type	Cast spoke
Tires, size	16.00-25
Ply-rating, front	20 or 24
rear	24

BODY EXHAUST HEATING: Provisions to permit passage of exhaust gases through area between wear plate and shell bottom; controlled by baffles and exhausted through second rear vertical bolster on right side.

CHASSIS EQUIPMENT: Front wheel brake limiting valve; separator for air system; 25,000 B.T.U. heater with defrosters; windshield defroster fan; engine chrome cylinder liners and stellite inlet valve seats; tachograph, Wagner "BB", 24-hour chart 0-3500 r.p.m. (in place of standard tachometer); speedometer (single-hand); exhaust outlet under cab suitable for attachment to body for body heating; automatic (air) radiator shutters; 20-ton jack, hydraulic; spare rim.

MACK LVX

capacity: 22½ tons



This four-wheel dumper with its 22½-ton rated capacity provides maximum payloads at minimum unit cost. Equipped with a 300-horsepower engine, over-gear transmission with two-speed compound or torque converter, and Mack's exclusive Planidrive rear axle assembly, it is powered to give top performance under the most punishing operating conditions.

All-welded, single-unit, alloy-steel frame gives LVX's stamina and rugged durability. Elbow steering column, hydraulic steering booster, two-plate air-assisted clutch, and job-engineered cab with extreme left driver position assure maximum operating efficiency. From top to bottom, this big Mack gives you the "extras" that mean minimum hauling costs.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	14′ 2″
Platform	9′ 11″
Overall Width	11′ 2″
Overall Height	11′ 6¼″
Overall Length	26′ 8½″
Overall Height (Body Raised)	21′
Turning Circle Diam. (To outside edge of tire)	62′
Weight (chassis, body & hoist)	40,800 lbs.
Payload	45,000 lbs.

ENGINE (Diesel):

Model	NHRBIS
Make	Cummins
Type	Supercharged
Number of cylinders	Six
Bore and stroke	5½″ x 6″
Piston displacement, cu. in.	743
Brake horsepower @ 2100 r.p.m. (gov.)	300
Max. torque @ 1500 r.p.m.	818 lb.-ft.

CLUTCH:

Type	Mack Two-plate, dry
Area of engagement, sq. in.	416
Actuation	Manual, with air assist

ELECTRICAL SYSTEM:
Voltage and capacity . 12 V., 50 Amp. (24 V. Starting)

TRANSMISSION:

Type	Mack selective, constant mesh
No. of speeds, forward	Eight
reverse	Two

FRONT AXLE:
Type . . . Mack Reversed-Elliott, drop forged I-beam

REAR AXLE:

Make	Mack Planidrive
Drive	Dual reduction, spiral bevel
Final drive (3rd reduction)	Planetary gear train within wheel hubs
Total Ratio	17.66

BRAKES (Air):

Compressor	Tu-Flo
Type	Internal expanding
Front, size	17¼″ x 5″ x ¾″
Rear, size	18″ x 10″ x ¾″
Hand, size	16″ x 3″ x ¼″

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	13¹¹⁄₁₆″ x 8″ x ⅜″ (Fabricated)
Section modulus	74.8 per rail

SPRINGS:

Front	
Type	Semi-elliptic
Suspension	Mack rubber shock insulators
Rear	
Type	Progressive rate, semi-elliptic
Suspension	Cam face slipper ends with radius rods

TIRES:

	Front	Rear
Size	14.00-24 (16P) Rib	18.00-25 (24P) Lug

WHEELS:
Type . . . Cast, spoke

STEERING GEAR:
Power steering assist . . . Vickers hydraulic booster

CAB:
Type . Heavy-duty off-highway, closed, all-steel, welded. Cab offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Screen type radiator guard; front and rear tow pins; air horn on cab roof; dual windshield wipers; two air reservoirs; rear view mirror, left side; exhaust through hood with inline muffler; channel type front bumper; stop-tail light; rim lug wrench and handle.

HOIST:
Type . . . Twin, double-acting, outboard mounted, three section telescopic cylinder assembly directly connected to body and chassis through a universal joint arrangement providing a 70° dumping angle.

BODY:

Type	Rock, with scoop end
Make	Heil
Capacity, line of plate	14.8 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

ENGINE:

Model	NRTO
Make & type	Cummins, turbocharged
Number of cylinders	Six
Bore and stroke	5½″ x 6″
Piston displacement, cu. in.	743
Brake H.P. @ 2100 r.p.m. (gov.)	335
Max. torque @ 1500 r.p.m.	900 lb.-ft.

TRANSMISSIONS:
Westinghouse Converter and Mack 4-Speed Transmission. Clutch—2-plate, 17″.
Allison Torqmatic Converter and Allison Transmission.

FRONT AXLE: Special Heavy-duty, Reversed-Elliott, Drop Forged I-beam.

TIRES:

	Front
Size	14.00-24 (20P) Rib

BODY:

Type	Flared Quarry
Make	Heil
Capacity, line of plate	15 cu. yds., struck

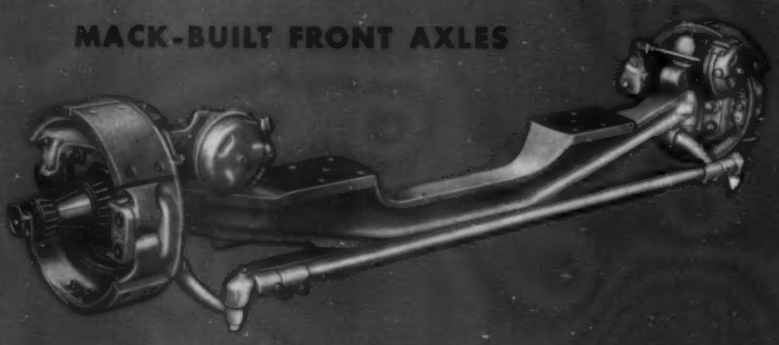
Construction: ¼″ steel plate shell bottom; ½″ sides; ⅜″ header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

Exhaust Heating: Provision for exhaust heating of dump body available.

CHASSIS EQUIPMENT: Air starting, Ingersoll-Rand 9HP; Tachograph, Wagner "BB" (24 hour chart 0-3500 r.p.m.) in place of standard tachometer; Wig-Wag low air pressure indicator; hand control valve to operate rear service brakes; front wheel brake limiting valve; 25,000 B.T.U. hot water cab heater with defrosters; windshield fan mounted on windshield header; hub-odometer; air operated radiator shutter; Schwitzer air operated Thermo-controlled radiator fan hub; speedometer; back-up light; hydraulic jack, 20-ton; spare rims.

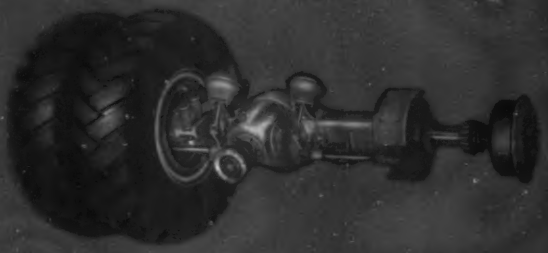
only MACK gives you features like these...

MACK-BUILT FRONT AXLES



Mack's reversed Elliott, forged I-beam front axles are made extra strong for long, trouble-free service. Extensive use of heat-treated steels for crucial parts means minimum maintenance. Straight tie rod and rugged construction of air-actuated brake shoes insure top performance.

MACK-BUILT 2-WHEEL REAR AXLES

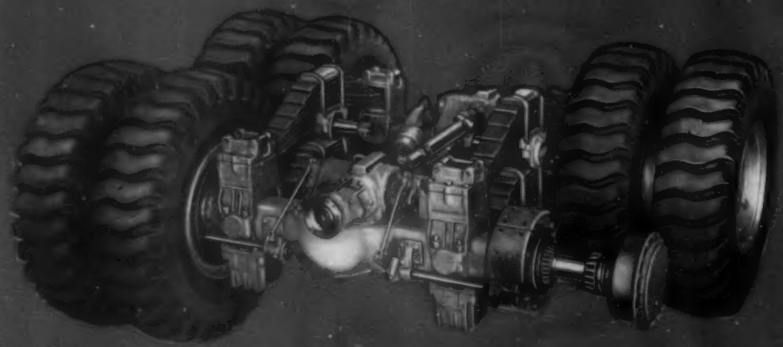


Mack's two-wheel, rear axle assemblies have an unmatched reputation for durability under strenuous service. The strongest, most wear-resistant materials are used throughout. Dual reduction, gear-type differential and Mack's famous planetary gear reduction at the wheel hubs (Planidrive) provide the smooth distribution of power needed for top truck performance. Planetary gears can be serviced or repaired without removing tires or disturbing wheel bearing adjustment.

MACK-BUILT TRANSMISSIONS

Dependable performance and long life are standard in Mack transmissions. Shown here is the heavy-duty overgear transmission used for the LRVSW, LRSW, and LVX off-highway dumpers. The four-speed main transmission and two-speed compound are assembled as a unit to give eight forward and two reverse speeds. The four-speed main transmission without the two-speed compound is offered in combination with torque converter. All gears use Mack tetrapoid or quadrapoid tooth design and are drop-forged, case-hardened, and generator-ground . . . gears noted for lasting the life of the truck.

MACK-BUILT 4-WHEEL BALANCED BOGIES WITH EXCLUSIVE POWER DIVIDER



Under the worst conditions of mud, loose gravel, or difficult terrain, you get maximum pulling power with Mack's four-wheel drive Balanced Bogies because exclusive Mack Power Dividers apply power to the wheels with traction. Planidrive final reduction gears in all four hubs provide needed reduction without excessively large carriers, differentials, or axle shafts. Maintenance is reduced to a minimum.

MACK LRVSW

capacity: 34 tons

The 34-ton rated capacity of this super-payload, six-wheel dumper assures minimum haulage costs for the big earth-moving jobs. Equipped with a 400-horsepower engine, four-speed overgear transmission, hydraulic torque converter or two-speed compound, and a balanced, four-wheel drive bogie, LRVSW's can negotiate severe grades fully loaded. Maneuverability and ease of handling are facilitated by such features as a hydraulic steering booster and air-assisted clutch. Heat-treated, stress-proportioned, single-unit frame gives the structural stamina needed to withstand severest operating conditions. All these features, and many more, contribute to unmatched durability and minimum haulage costs.

CONDENSED SPECIFICATIONS

STANDARD EQUIPMENT

DIMENSIONS:

Wheelbase	16′ 10″
Platform	14′ 11½″
Overall Width	11′ 1⅜″
Overall Height	11′ 11″
Overall Length	31′ 7″
Overall Height (Body Raised)	25′ 2″
Turning Circle Diameter (To outside edge of tire)	78′
Weight (chassis, body & hoist)	68,000 lbs.
Payload	68,000 lbs.

ENGINE (Diesel):

Model	NVH-1200
Make	Cummins
Type	Naturally aspirated
Number of cylinders	12
Bore and stroke	5¼″ x 6″
Piston displacement, cu. in.	1486
Brake horsepower @ 2100 r.p.m. (gov.)	400
Max. torque @ 1200 r.p.m.	1,075 lb.-ft.
Fuel tank and location	150 gal., back of cab

CLUTCH:

Make	Lipe Rollway
Type	Two-plate, dry
Area of engagement, sq. in.	571
Actuation	Manual, air assist

ELECTRICAL SYSTEM:

Voltage and capacity	12 V., 75 Amp.
Generator, make and type	Leece-Neville, alternator

STARTING SYSTEM:

Starting motor, type	Air
Make	Bendix-Westinghouse
Rating, horsepower	25
Cold starting aid	Ether injection

TRANSMISSION:

Type	Mack selective constant mesh
No. of speeds, forward	Four
reverse	One

TORQUE CONVERTER:

Model	Westinghouse 18″
Type	Single stage, hydraulic

FRONT AXLE:

Type	Mack Reversed-Elliott, I-beam drop forged

BOGIE:

Make	Mack Planidrive
Final drive, type	Four wheel, planetary
Inter-axle Differential	Mack concentric cam and plunger type Power Divider
Carriers	Mack dual reduction
Total ratio	18.18

BRAKES:

Type and actuation	Internal expanding, inclosed, air
Front, size	17¼″ x 5″ x ¾″
Rear, size	20″ x 7″ x ¾″
Hand, size	16″ x 3″ x ⅛″, four-shoe, disc

FRAME:

Type	I-beam, wide flange
Material	Alloy steel
Side-members, size	Depth 14¼″, flange width 8″, flange thickness ½″
Section modulus	130.0 per side

SPRINGS:

Type	Semi-elliptic
Suspension, Mack	Rubber Shock Insulators

SHOCK ABSORBERS, FRONT:

Type	Houdaille, hydraulic

TIRES (Lug) Front and Rear:

Size	16.00-25 (20P)

WHEELS:

Type	Cast, spoke

STEERING GEAR:

Type	Worm and roller
Power steering assist	Vickers hydraulic booster

CAB:

Type . . Heavy-duty off-highway, closed, all-steel, welded. Offset 10¾″ to left of chassis centerline provides clear vision for driver to rear.

CHASSIS EQUIPMENT: Screen type radiator guard; hubodometer; front and rear tow pins; air horn; rear view mirror, left side; dual exhaust through hood with inline mufflers; channel type front bumper; rim lug wrench and handle; door in hood side for access to oil filler and dip stick; insulating dash mat; windshield wipers; stop and tail light; back up light.

HOIST:

Make & Type . . Heil, twin, double-acting, outboard mounted, four-section telescopic cylinder assembly directly connected to body and chassis through a universal joint arrangement to provide maximum flexibility.

Dumping angle . 70°

BODY:

Make & Type	Heil Rock, scoop end
Capacity, line of plate	24 cu. yds. struck

Construction: ¼″ steel plate shell bottom; ⅜″ sides and header; ½″ wear and side bevel plates; ¼″ canopy. 3″ x 7.1 lb. channels between floor plates either side of a 2″ edge-grain hardwood middle section filler.

OPTIONAL EQUIPMENT

TRANSMISSION (In place of 4-Speed and Westinghouse Converter):

Make & Type	Mack Two-Lever, Duplex
Speeds Forward	8
Speeds Reverse	2

TIRES (Lug) Front and Rear:

Size	16.00-25 (24P)

BODY EXHAUST HEATING: Provisions to permit passage of exhaust gases through area between wear plate and shell bottom; controlled by baffles and exhausted through second rear vertical bolster on right side.

CHASSIS EQUIPMENT: Front wheel brake limiting valve; 25,000 B.T.U. heater with defrosters; windshield fan; speedometer (single-hand); tachograph, Wagner "BB"—24-hour chart, 0-3500 r.p.m. (in place of standard tachometer); engine fan—Schwitzer-Cummins fan drive with automatic temperature control; exhaust outlet under cab suitable for attachment to body for body heating; 20-ton hydraulic jack; spare rim.

MACK first name for TRUCKS

Mack Trucks, Inc., Plainfield, New Jersey • In Canada: Mack Trucks of Canada, Ltd.

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No. 17 "Chemistry of Cyanidation", by Hedley and Tabachnik. Fundamentals, plus data on zinc, copper and iron in cyanidation.

No. 19 "Heavy-Media Separation Processes for Mineral Concentration." Fundamentals of HMS processes, bibliography and examples of practice on a variety of ores and non-metallic minerals.

No. 20 "Cyanamid Reagents." Descriptions of Cyanamid flotation reagents plus data on processing of various types of ores.

No. 21 "Froth Flotation", by R. B. Booth. Summary of flotation fundamentals with patent and literature references.

No. 22 "Handling and Feeding of AERO® Brand Cyanide." Detailed information on safe feeding arrangements for this widely used product including descriptions of methods for large and small cyanide and flotation operations.

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One Responsibility

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How DENVER SRL (Soft Rubber Lined) PUMPS CAN CUT YOUR PUMPING COSTS...for abrasive pulps or tailings

1. POWER COSTS CUT

Denver SRL Pumps often use less than one-half the brake horsepower required by other pumps in similar service. This is the result of simplified design and high efficiency of molded rubber parts. **This means substantial savings for you in power costs and maintenance.**

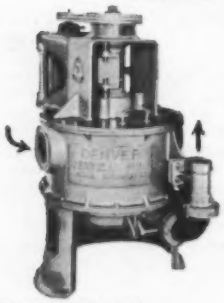
2. SHUTDOWN TIME REDUCED

Because molded rubber parts are highly resistant to corrosion and abrasion, case history records show where Denver SRL parts lasted up to 15 times longer than parts on pumps previously on the same service. This means increased production, savings for you in maintenance costs—and, more important, reduced down time.

3. A PUMP FOR EVERY JOB

Denver SRL Rubber Lined Pumps are available to you for standard or heavy duty service and with capacities up to 2400 g.p.m. You can choose exactly the right pump that will do your pumping job most efficiently, most economically. Parts for all sizes are kept in stock for fast service.

If you have abrasive or corrosive material to pump, you can make substantial savings by using Denver SRL Rubber Lined Pumps. For complete information about what Denver SRL pumps can do for you, **WRITE TODAY FOR FREE BULLETIN P9-B8. MOST SIZES OF SRL PUMPS IN DENVER STOCK.**



DENVER VERTICAL CENTRIFUGAL SAND PUMP . . . for use where

1. Feed is intermittent.
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4. Floor space is limited.
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Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

March 1957

INTERNATIONAL PANORAMA

MONTREAL, QUEBEC—Iron Ore Company of Canada has set a 1957 shipping and sales goal of 13,000,000 tons for its properties in the Quebec-Labrador ore fields. About 12,000,000 tons were sold in 1956. Dumping and shipping facilities at Seven Islands were designed to handle only 10,000,000 tons.

LONDON, ENGLAND—A group of British financial houses plan to contest the offer of a United States controlled firm, Tsumeb Corporation, to purchase the South West Africa Company, producer of vanadium.

CLIMAX, COLORADO—Climax Molybdenum Company has mined its 100,000,000th ton of molybdenum ore at the Climax mine. Development was first begun in 1918; closed, then reopened in 1924. Production has increased from 200 tons daily at that time to 34,000 tons daily at present.

BOSS MOUNTAIN, BRITISH COLUMBIA—Climax Molybdenum Company has completed five diamond drill holes at its property here to indicate 1,000,000 tons of 0.90 percent Mo.

KITWE, NORTHERN RHODESIA—Vanadium Corporation of America's Rhodesian subsidiary, Rhodesian Vanadium Corporation, has secured a 2,460 square mile concession known as the Chilili East Manganese Area. Vanadium has sole prospecting and staking rights to the concession.

QUEBEC CITY, CANADA—United State Steel Corporation's subsidiary —Cartier Mining Company—is planning a new open pit mine and 10,000,000-annual-ton pellet plant in the Mount Wright and Mount Reed districts 300 miles northeast of here. Ore is magnetite averaging 30 percent Fe.

WASHINGTON, D. C.—The Joint Committee on Defense Production has announced that expansion goals set in 1950 to assure adequate war time supplies have not yet been completed for chemical grade chromite, battery and chemical grades manganese, mercury, nickel, and selenium.

WEIPA, QUEENSLAND, AUSTRALIA—The bauxite deposit on Cape York Peninsula now being explored may prove to be one of the world's largest as prospecting continues successfully.

CLEVELAND, OHIO—Cleveland-Cliffs Iron Company has raised iron ore prices 60 cents a gross ton, or more than five percent, for shipments of Lake Superior ores in 1957. Other iron ore companies are expected to follow suit.

SAN FRANCISCO, CALIFORNIA—Uranium ore production in United States in last half of 1956 was 1,660,000 tons, almost double the 840,000 in last six months of 1955. Uranium oxide concentrate output was 3,400 tons in last half of year compared with 1,600 in same 1955 period.

LIMA, PERU—Production of gold, copper, lead, and iron reached all-time highs in Peru in 1955. Gold output was 6,040,382 grams; copper, 46,350 metric tons; lead, 129,074; and iron, 2,200,246.

DOMNARVET, SWEDEN—A new 475,000-annual-ton oxygen converter process steel mill will be built here by Stora Kopparbergs Bergslags A/B. This is the first mill in the world to use the new rotating oxygen converters.

BORON, CALIFORNIA—The United States Geological Survey is drilling three deep test holes east of here in the search for borax minerals. It is part of long range program to develop more boron—"The Metal of Year 1956".

SAN FRANCISCO, CALIFORNIA—Primary aluminum output in the United States during 1956 broke all previous annual records. Output was 1,679,431 short tons, up from 1,565,719 in 1955.

WASHINGTON, D. C.—The proposed Federal budget for fiscal year 1958 requests authority for $245,000,000 to be spent for stockpile purchases; $130,000,000 as new authority. Most purchases will be metals with $69,000,000 from direct open market, $71,000,000 from Defense Production act purchases, and $105,000,000 for bartering.

COPPER CLIFFS, ONTARIO—International Nickel Company of Canada, Ltd. and Texas Gulf Sulphur Company have joined to operate a pilot plant for testing of hydrocarbon fuels as sulphur reducing agents on roaster gas with a high sulphur dioxide content.

TOKYO, JAPAN—Production of copper, lead, zinc, and nickel metals reached an all-time high in 1956. Tin metal output was a post World War II high, but not a record.

Supreme Court Will Hear Full Gold Testimony

The Supreme Court of the United States announced on January 15th that the full court will review the decision of the United States Court of Claims in the matter of damages from the WPB forced closing of gold mines under L-208. Six gold mining companies won their case before the Court of Claims when it ruled damages should be recovered.

The case is now on the summary calendar of the Supreme Court and it is expected that oral arguments should be presented about May.

UN Atomic Energy Statute Signed by 76 Countries

Iraq is the 76th country to sign the statute of the International Atomic Energy Agency, which was approved unanimously by an 81-nation conference at United Nations headquarters last October. Other recent signers are Italy, Mexico, Tunisia, Burma, and Morocco.

The 23-article statute which will go into force when ratified by 18 states, sets out plans for an international agency which "shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world." It provides that the agency shall ensure, so far as possible, "that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose."

New Oxygen Process Cuts Steel Production Costs

A new oxygen converter process, estimated to save $3.00 a ton in steelmaking, will be put in use at an ultra-modern mill under construction in the central part of Sweden on the coast of Oxelosund. The mill capacity will be 475,000 tons annually.

The new Kal-Do process was developed by Stora Kopparberg Corporation, New York City, a subsidiary of Stora Kopparbergs Bergslags A/B, of Domnarvet, Sweden. Two 80-ton rotating oxygen converters will be installed in the melt shop of the new mill, which will be erected by the mining company of Trafikaktiebolaget Grangesberg-Oxelosund. It will cost about 200,000,000 Swedish crowns and start production in 1960.

This represents the first licensing for the new Kal-Do method. A number of United States steel mills are now studying the process.

The iron ore will be supplied from Trafikaktiebolaget's mines in Grangesberg and Strassa, which will produce about 2,000,000 tons per year. The new mill will utilize about 500,000 tons of ore per year.

REPUBLIC MINE AND MILL from the air. Ore is trucked from pit at lower right to primary crusher (right center), conveyed to secondary and tertiary crushing building behind tank, and to main flotation building at left.

Marquette's New Republic Mill Makes Iron Flotation Look Easy

By GEORGE O. ARGALL, JR.
Editor

If you have anything to do with metallurgy, and if you are particularly interested in flotation, you will have to search a long time to find a better iron flotation mill than the new Republic mill erected by The Cleveland-Cliffs Iron Company for the Marquette Iron Mining Company. In fact, if you deal with milling of any kind you will have to take an equally long look to find a better designed, well constructed, perfectly maintained, carefully supervised, and efficiently operated flotation mill than Republic.

Marquette Iron, owned by The Cleveland-Cliffs Iron Company (47.5 percent, the operating company), Jones & Laughlin Steel Corporation, International Harvester Company, The Wheeling Steel Corporation, and Inland Steel Company, operates the Republic open-pit mine and 3,400-long-ton-per-day flotation mill at Republic, Michigan.

Republic was a leading Marquette Range underground mine from 1872 to 1937 with a total production of 8,563,170 tons of high grade lump ore. The ore is jaspelite or specular hematite assaying 40.0 percent iron and 41.5 percent SiO_2. It has a specific gravity of 3.45, and is extremely hard and abrasive. A typical chunk shows interbanding of specular hematite and chert. Individual bands vary from several hundredths to an inch in thickness. Metallurgically the ore is considered to be "hard and clean" and more easily floated than many of the softer oxidized taconite iron ores. The jaspelite has hard stable grain surfaces permitting a strong attachment by a reagent film; the surface area of mineral grains which must be coated is less than for other iron ores; and there is a minimum of oxidized compounds and primary slimes to interfere with flotation.

Humboldt Was Pioneer

Cleveland-Cliffs knew how to mill specular hematite and how to design and build an ideal mill because of its two years' operating experience at nearby Humboldt Mining Company. Humboldt was the first commercial flotation mill treating this type of ore in the United States. Today it is a very successful commercial operation producing more than its designed concentrate capacity each month.

Don't think for a minute, though, that Republic is the final answer to iron ore flotation. Cleveland-Cliffs engineers are constantly seeking methods and equipment to improve metallurgy at lower costs. Republic expansion—and the plant was built with this in mind—will take advantage of Republic experience.

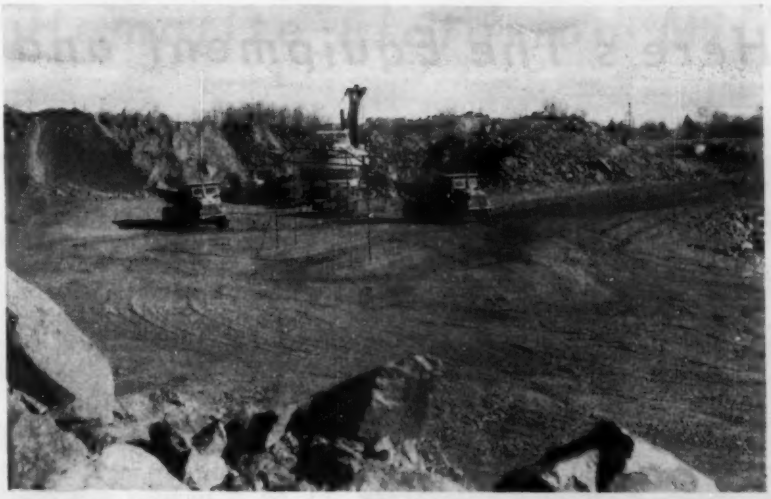
Republic is fortunate that the men that pioneered and made Humboldt successful are now operating this new plant. They include: Grover J. Holt, general manager of Cleveland-Cliffs; J. S. Westwater, manager of Michigan mines; H. C. Swanson, district superintendent, open pit mines; L. J. Erck, chief metallurgist; and D. K. Campbell, project engineer. The Republic operating staff is headed by Emert W. Lindroos, superintendent; Richard Smith, metallurgist; Joseph

Crites, pit foreman; Everett Waisanen, mill foreman; Robert Flynn, mining engineer; Louis Tousignant, crusher foreman; Thomas Carey, maintenance foreman; William Stratton, shop foreman; Charles Cornish, surveyor; and Lauro Perucco, mine clerk.

Why Republic Is Superior

Here are important reasons why Republic is operating so efficiently:

- Flotation circuits have all gravity flow. This obviates the trouble and cost of pumping frothy pulp.
- Same types of flotation cells are used in each circuit.
- Flotation machines are built with double launders so that circuit flow or by pass changes can easily be made.
- Primary crusher discharge is transferred to conveyor belt by a pan feeder.
- Adequate working space has been designed around each operating unit.
- There is sufficient head room for clean up under the grinding-classification, and flotation-filtering floors. This makes room for a front-end, rubber-tired loader and small dump truck to operate in cleaning up spills.
- An underground tunnel connects mill building and dry (in basement of shop-office) so that workmen will not have to go outside mill on way to change clothes.
- There are only two main floor levels so that mill operators can see and easily operate equipment.
- Rod and ball mills are elevated so that mill operator can stand on floor and look directly into discharge end of mills to check grinding action.
- Steel-grate floors are used so that all spills on operating level drop into lower level for mechanized clean up.
- There are overhead cranes over all machinery.
- Adequate room has been provided around mill equipment so that a truck can be driven alongside to facilitate emergency repairs and supply deliveries.
- There is a railroad track into main mill building with overhead mill crane available for unloading cars.
- The warehouse under main mill roof is serviced by overhead mill crane so that grinding media and repair parts can be readily handled from storage to use.
- Warehouse is large so that all mill supplies are handled in railroad freight car lots.



FIRST BENCH in the Republic mine. The hard specular hematite is jet pierced, blasted, and loaded by electric shovel into 34-ton Diesel trucks and hauled to nearby primary crushing. Special winter mining methods are used.

- Lower floor under machinery is separated into two levels. The upper, where low grade mill-classifier spill can be cleaned up. This floor is separated from lower concentrate-spill-floor by launder leading to tailing pond. The lower cleanup floor is under high grade spill—flotation, thickener, filtering—which can be washed to sump and recovered by pumping to thickener.
- There is stage conditioning of sized flotation feed in accordance with varied flotability characteristics.
- There is rejection of slime fraction ahead of flotation.
- There are well engineered belt transfer points with cyclonic dust collector at each transfer which drop dust back on succeeding up-circuit belt.

Cleveland-Cliffs has owned the Republic mine since 1914. Last underground ore was mined in 1937. In 1947 a program was started to determine if an open pit mine could be developed, and if the iron formation could be upgraded by a commercially feasible process. Metallurgical studies were undertaken and diamond drilling outlined the iron formation.

Grind as Measured by Size Distribution of Hydrosecillator Overflow, or Feed to Primary Cyclone

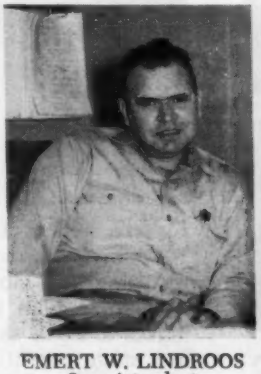
Republic Flotation Mill
Marquette Iron Mining Company

Size Mesh	*Percent*	*Cumulative Percent*
35	0.65	0.65
48	1.30	1.95
65	2.76	4.71
100	6.18	10.89
150	10.24	21.13
200	14.31	35.44
200	64.56	—

Clearing the mill area and excavating for the primary crusher were first on the construction program. Stripping of overburden at the open pit started in the spring of 1955. The mill was completed and first ore treated in March 1956.

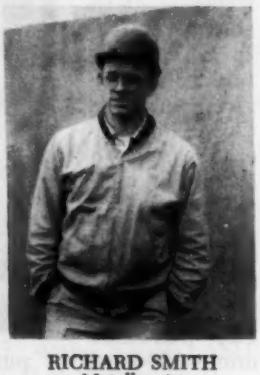
Cleveland-Cliffs acted as prime contractor for the mill with the Abe W.

Continued on page 46 (WM28)
Overleaf: Mill Highlights



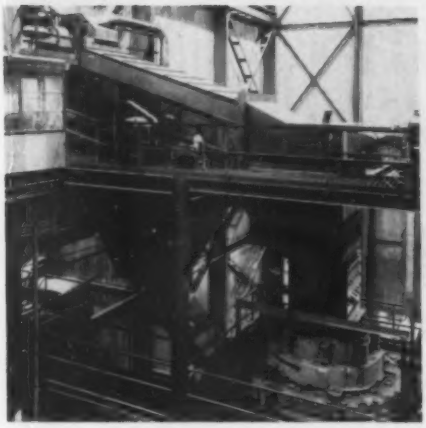
EMERT W. LINDROOS
Superintendent

JOSEPH CRITES
Pit foreman

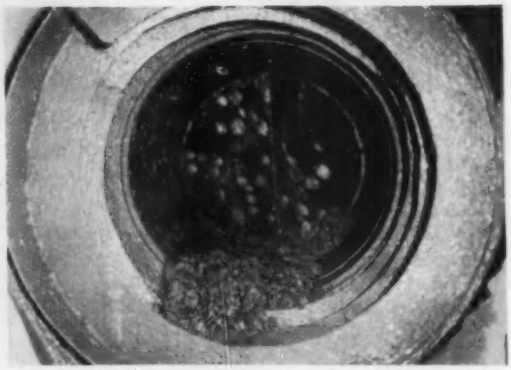


RICHARD SMITH
Metallurgist

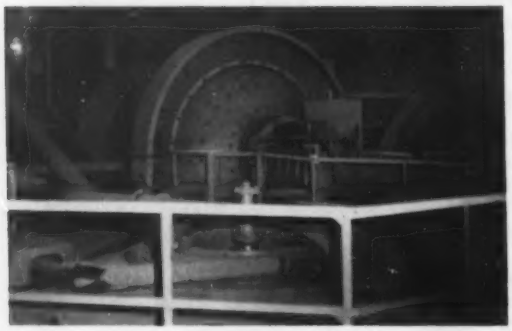
Here's The Equipment and What It Does



1. Tertiary crushing: Symons short-head 7-foot unit handles two products from a 6 by 14 foot double deck Simplicity screen. Screen oversize from top deck is plus-2-inches (1 by 2 inch slotted screen), and plus-½-inch minus-1-inch (½ by 1 inch slot) from lower deck. Undersize passing lower deck joins crusher discharge on 358 foot long 36-inch conveyor belt leading from secondary crushing building to main mill building.

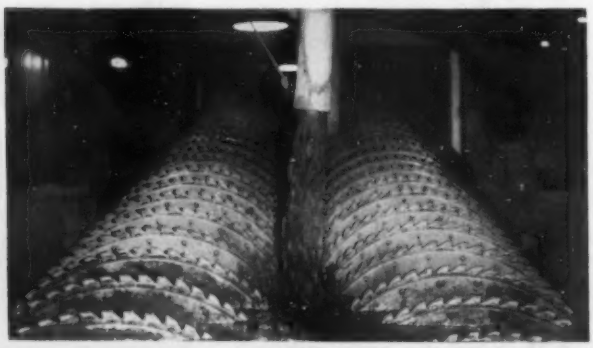


2. Rod mill: Primary grinding is in a 9 by 12 foot Hardinge mill in open circuit. Feed is nominally ½-inch, but there are some larger flat slabby pieces. Rod mill grind is to 8-mesh pulp which is 78 percent solids. Grinding rods are 3½ inch.



3. Hydroscillator and Ball Mill: Rod mill pulp flows directly to a 14 foot Dorr-Oliver hydrocillator. This unit is in closed circuit with the ball mill. Overflow, 64.56 percent minus-200-mesh, is pumped directly to primary cyclone. Sand is raked to ball mill. Feed is sand, normally plus-48-mesh, from the hydroscillator to the 11 by 3 by 6 by 10 foot Hardinge tricone. Overflow recycles. Balls are 1¼-inch forged steel. Pulp density is 68 percent. Both rod and ball mills are driven by identical 450 horsepower synchronous electric motors. Rod and ball mills are elevated so that operators can stand on floor and look directly into discharge end to check grinding.

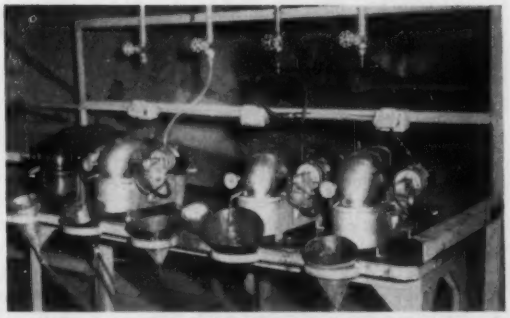
4. Primary cyclone: Feed is 30 percent solids with screen analysis shown in accompanying table. The 24-inch Dorr-Oliver unit operates under a 12 to 15 pound pressure. Underflow gravitates directly to Akins densifiers. Overflow, 100 percent minus-150-mesh, is pumped to the secondary cyclones.



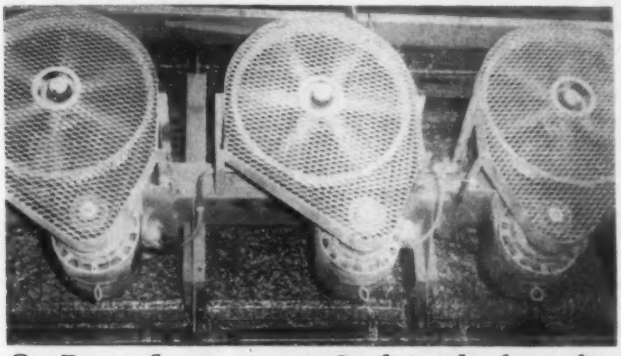
5. Densifier: This 54-inch duplex Akins performs several important functions. It takes up surge, resulting in a more uniform flotation feed. It can be used to reclaim water, when and if needed. And it makes a clean sand product which goes directly to first stage conditioning. Overflow, 80 percent solids, is fed to secondary cyclones.

In Republic's Hematite Flotation Mill

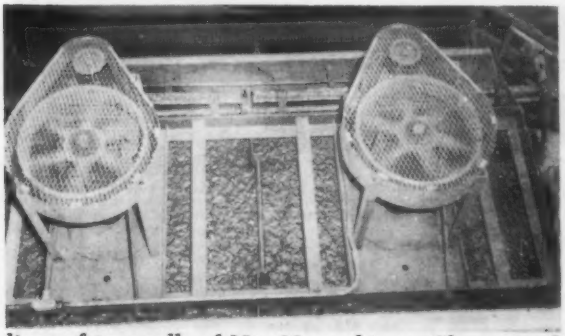
6. Secondary cyclones: Main function is to discard a slime tailing which assays 30.0 percent iron. This fine iron isn't worth the cost of the reagents necessary to recover it. By discarding the slime fraction. a clean feed is sent to flotation. Ideal feed, is 100 percent minus-48-mesh, and 100 percent plus-20-microns in size. Overflow of the 24 6-inch Dorr clones, flows to the fourth conditioning stage. Secondary cyclone feed is at 40 pounds per square inch pressure generated by two 8-inch pumps in series.



7. Reagents: Only two reagents, a frother and a collector, are used and they are metered by Clarkson feeders and added to the first conditioner. Methyl Isobutyl Carbonal, Shell brand, is added at the rate of 0.15 pounds per ton of mill feed for a frother. Promoter is Acintol FA No. 2, made by Arizona Chemical Company, a subsidiary of American Cyanamid Company. This fatty acid is a refined tall oil high in dleil and linoleaic acids and is used at the rate of 1.2 pounds per feed ton. Reagent additive rates are carefully controlled according to tonnage and grade of mill feed.



8. Denver flotation circuit: Conditioned pulp is split in three parts to feed three lines of five cells of Denver Sub-A No. 24 roughers which make a tailing (flows to scavengers), and a concentrate. Rougher concentrate flows to three lines of three cells of No. 24 cleaners. Cleaner tailing is returned to pulp distributor and concentrate is recleaner feed. The recleaners are three lines of three cells of No. 24 machines. Concentrate is pumped to thickner and tailing recycles to pulp distributor. Three lines of two cells of Denver Sub-A No. 30 scavengers make a final circuit tailing with the scavenger concentrate recycling to head of circuit, with cleaner and recleaner tailing.



9. Fagergren flotation circuit: Pulp from two way distributor goes to two lines of four cells of Fagergren No. 66 roughers. Rougher tailing flows to scavenger feed, and concentrate to the cleaners which are two lines of two cells of No. 66 machines. Cleaner tailing recycles to head of circuit and concentrate flows to recleaners. Recleaner concentrate is pumped to thickener, and tailing recycles. Two lines of two cells of No. 66 Fagergrens are used for scavengers. Tailing is final mill tailing and concentrate is returned to head of circuit.

10. Mill pumping: All pumps are rubber lined. Flotation concentrates are pumped to thickneners by 8-inch Wilfley Model K units. Hydroscillator overflow, densifier overflow, and conditioned flotation pulp are pumped with 8-inch ASH Model CD Hydroseal units.

Assay of Mill Feed and Flotation Concentrate at Marquette Iron Mining Company's Republic, Michigan Concentrator for September, 1956.

Component	*Heads*[1]	*Flotation Concentrate*[2]	*Tailing*	*Hydrosillator Overflow*	*Secondary Cyclone Overflow*
Iron	40.0	63.25	7.5	40.0	30.0
SiO_2	41.5	8.05	81.5	—	—
P	—	0.038	—	—	—

1. Ore weighs 125 pounds per cubic foot, 3.45 specific gravity.
2. Concentrate weighs 141 pounds per cubic foot, 4.60 specific gravity.

Matthews Engineering Company of Hibbing, Minnesota doing all the detail design work on equipment installation. The Ralph Boeck Company of Milwaukee, Wisconsin designed the foundations and structural steel work. All buildings are winterized with double layers of corrugated iron sheeting holding a core of fiber glass insulation 2-inches thick. There are only a few small windows in the mill so both mercury vapor and incandescent lighting are used.

Open Pit Mining

The open pit is being developed for mining of 40 foot high benches. All work to date has consisted of stripping from 0 to 50 feet of sand and gravel overburden from the very irregular upper surface of the ore and establishing benches around and adjacent to several large open stopes mined through to the surface during earlier operations.

The same equipment and general methods are used for both summer and winter mining. However, winter operations are designed to keep snow out of the broken ore. Snow mixed with ore turns to a mushy slop of ore and snow in the crushing plants which then freezes in the chutes. Therefore, winter mining is done with small blasts and fast ore loading. Fly rock from a winter blast is never pushed into the muck pile because that would add snow. Fly rock and snow are pushed out of the mining area. In summer the reverse is true. Blasts are big; as many holes are shot at one time as the powder crew can load in a shift. The shovel loads from one muck pile for a week or longer, and the fly rock is bulldozed into muck pile.

Blast holes are jet pierced with a Bucyrus-Erie machine. Seven inch holes spaced on 18 foot centers are pierced at an average rate of 11 to 12 feet per hour.

Jet piercing burns 10,000 cubic feet of oxygen per hour so a 300,000 cubic foot converter has been built by Linde Oxygen Company adjacent to the railroad spur leading into the mill. Liquid oxygen is delivered in railroad tank cars holding 750,000 cubic feet. From the storage tank oxygen is piped to the nearby pit area and then fed to the jet piercing machine through rubber hoses, in gaseous form.

Early drilling with 4-inch tungsten carbide bits was abandoned when one bit would only drill four feet. Piercing gives the added advantage of readily chambering the bottom of the hole to a 15 inch diameter. Six by 30 inch cartridges of 60 percent dynamite are loaded into the hole and waterproof powder pellets are then poured into the hole to fill all voids around cartridges. Powder factor to date has been 0.45 pounds per ton of ore broken. Holes are shot with millisecond delay caps connected by Primacord.

There is no secondary blasting. All chunks are broken with a five ton drop ball swung by a Brownhoist crane.

Drop balling has proved especially advantageous in starting the pit where working faces are small and the shovel doesn't have to be moved out, as would be necessary if powder were used for secondary breaking. Other advantages are less noise, and no vibration. Between 80 and 100 chunks are broken to shovel loading size per shift.

All ore is loaded with a Marion 4161 electric shovel with a 5 cubic yard bucket for the heavy ore, rather than the normal 6 yard for the shovel. Three Euclid 34 ton Diesel trucks are used with the shovel for the short haul to the crushing plant. Normal production is about 3,200 tons per day. All pit roads are surfaced with crushed ore to speed hauling and to cut down on tire and truck wear.

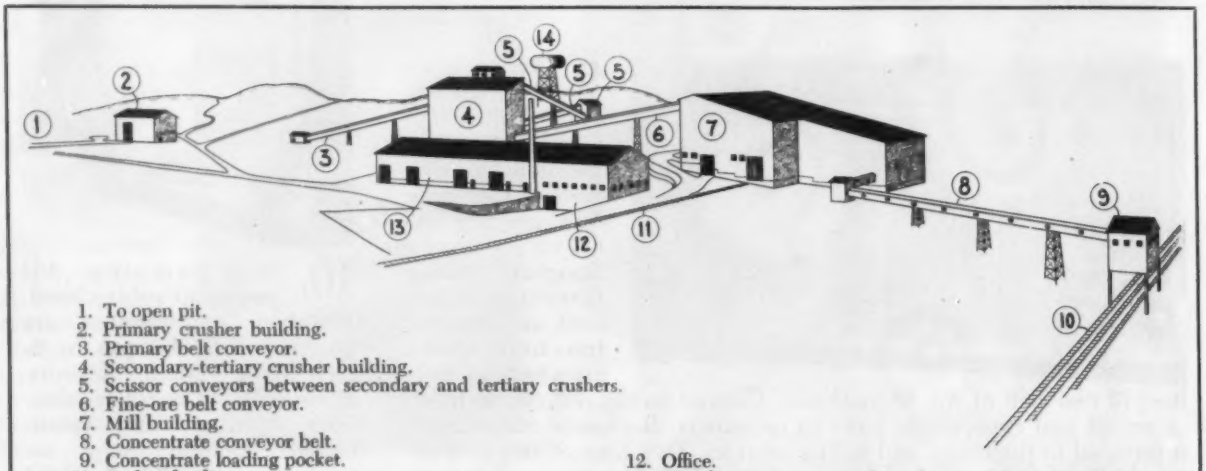
A Caterpillar D 8 bulldozer is used in the pit and a D 7 for stripping.

Plant and Equipment Highlights

Primary crushing: Trucks dump directly into 48-inch Traylor gyratory. The crusher building has doors on opposite sides so that winter dumping can always be on the lee side. This also permits equalization of crusher wear.

Secondary crushing: Symons standard 7 foot cone crusher handles plus-4-inch, and plus-2-inch minus-4-inch feed from 6 by 12 foot double deck Simplicity screen. Minus-2-inch undersize from lower deck joins crusher discharge to 150 ton surge bin ahead of tertiary crushing. Top screen has 4-inch square openings and bottom

Continued on page 123 (WM36)

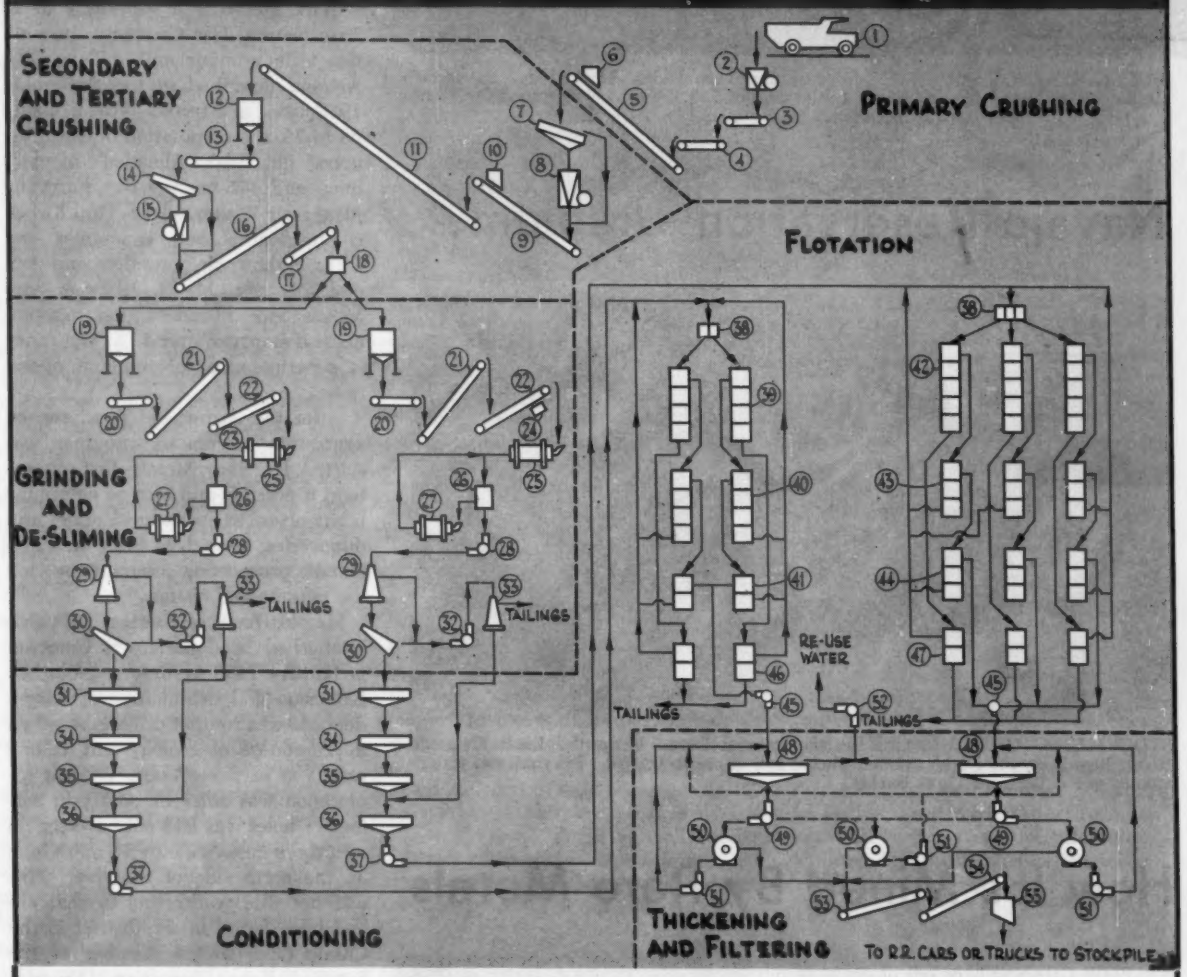


1. To open pit.
2. Primary crusher building.
3. Primary belt conveyor.
4. Secondary-tertiary crusher building.
5. Scissor conveyors between secondary and tertiary crushers.
6. Fine-ore belt conveyor.
7. Mill building.
8. Concentrate conveyor belt.
9. Concentrate loading pocket.
10. Railroad sidings.
11. Inbound railroad tracks.
12. Office.
13. Warehouse, garage, machine shop, and dry in basement.
14. Water tank.

Flowsheet

Marquette Iron Mining Company's Republic Specular Hematite Flotation Mill

Republic, Michigan



Primary Crushing

1. Euclid 34-ton truck from pit.
2. Gyratory crusher, 48-inch Traylor.
3. Pan feeder, 48-inch Pioneer.
4. Buffer belt.
5. Conveyor belt, 42-inch by 640 feet with 180° twist at head end.
6. Metal detector, Dings.

Secondary and Tertiary Crushing

7. Double deck screen, 6 by 12 foot Simplicity. Top deck 4-inch square openings, bottom deck 2-inch square openings.
8. Cone crusher, 7-foot Symons standard.
9. Conveyor belt, 36 inch by 237 feet.

Switch → Tower

10. Metal detector, Dings.

← Switch

11. Conveyor belt, 36 inch by 212 feet.
12. Surge bin, 150 long ton.
13. Feeder.
14. Double deck screen, 6 by 14 foot Simplicity. Top deck 1 by 2 inch slots, bottom deck ½ by 1 inch slots.
15. Cone crusher, 7-foot Symons shorthead.
16. Conveyor belt, 36-inch by 358 feet.
17. Conveyor belt, 36-inch by 222 feet.
18. Tripper, Hewitt-Robins.

Grinding and Desliming

19. Fine ore bin. Steel catenary type.
20. Belt feeders, five Link-Belt.
21. Conveyor belt, 24-inch by 63 feet.
22. Conveyor belt, rod mill feed, 24-inch by 52 feet 2 inches.
23. Conveyoflo scale, Unit No. 1.
24. Transportometer scale, Unit No. 2.
25. Rod mill, 9 by 12 foot Hardinge.
26. Hydroscillator, 14 foot Dorr-Oliver.
27. Ball mill, 11 by 3 by 6 by 10 foot Hardings Tricone.
28. Sand pump, 8-inch Model CD ASH.
29. Dorrclone, 24-inch primary.
30. Densifier, 54-inch Akins duplex.

Conditioning

31. 34, 35, and 36. Conditioners, 64 cubic feet with Denver mechanisms and 24-inch propellers.
32. Pumps, two 8-inch model CD ASH.
33. Dorrclones, 24 6-inch secondary units.
37. Pump, 8-inch model CD ASH.

Flotation

38. Pulp distributor, 5-foot Denver.
39. Rougher flotation cells, two lines of four No. 66 Fagergren.
40. Cleaner flotation cells, two lines of two No. 66 Fagergren.
41. Recleaner flotation cells, two lines of two No. 66 Fagergren.
42. Rougher flotation cells, three lines of five No. 24 Denver Sub-A.
43. Cleaner flotation cells, three lines of three No. 24 Denver Sub-A.
44. Recleaner flotation cells, three lines of three No. 24 Denver Sub-A.
45. Concentrate pump, 8-inch model K Wilfley.
46. Scavenger flotation cells, two lines of two No. 66 Fagergren.
47. Scavenger flotation cells, three lines of two No. 30 Denver Sub-A.

Thickening—Filtering

48. Thickener, 30-foot Dorr-Oliver.
49. Pump, 4-inch model B ASH.
50. Drum filter, 8 by 10 foot Eimco.
51. Filtrate pump, 2-inch Worthington.
52. Pumps, two 4-inch CT Hazelton.
53. Conveyor belt, 24 inch by 143 feet.
54. Conveyor belt, 24 inch by 340 feet.
55. Loading pocket.

BULLDOZING OVERBURDEN from uranium ore bodies blocked out by surface drilling. Rare Metals has scheduled a minimum of 727,525 tons of stripping for 10 ore bodies on the Arrowhead claims in northeastern Arizona.

Navajo Reservation Uranium...

STOCKPILING URANIUM ORE on the Painted Desert along the Little Colorado River. Navajo operator adds another bucket full of ore to the pile. International tractor mounts one cubic yard Drott Bucket.

How It's Mined By Rare Metals

NARROW CHANNEL or roll of ore is cleanly mined after stripping. Waste in bank at right is not moved. Low-grade ore at left will be mined separately. Open pitting has advantage of making ore channels easy to follow.

Rare Metals Corporation of America entered the uranium exploration and mining business late in 1954 by purchasing all the capital stock of the Arrowhead Uranium Company. This purchase gave the firm control of several operating open pit uranium mines, Navajo tribal permits, and mining claims on the Navajo Indian Reservation north and south of the Little Colorado River within a 12-mile radius of Cameron, Arizona.

Rare Metals is a subsidiary of El Paso Natural Gas Company. In addition to its uranium mill at Tuba City, Arizona described in the September 1956 issue of MINING WORLD, pages 68 to 73, the corporation operates the open pit Idaho-Almaden mercury mine and 175-ton per day furnacing plant near Weiser, Idaho. Paul Kayser is president of both companies, and C. L. Perkins, vice president and general manager. M. H. Kline is Rare Metals vice president and assistant general manager, and A. A. McKinney is superintendent of uranium operations.

After the Arrowhead purchase, an aggressive exploration program was started by Rare Metals—first, to extend if possible and then to determine limits of ore at Arrowhead mines and discoveries; second, to carry on a systematic prospecting program covering the permits and claims.

Harold Horst, exploration geologist, established headquarters at Cameron in January 1955 to direct exploration. Extension and delimitation of known deposits was routine drilling based on interpretation of geology and drilling results at each ore body. Wildcat exploration was different, so a grid pattern of holes was laid out covering an area three miles wide by 18 miles long on the north side of the river. This was not true wildcatting in that ore had been found in the district in the Chinle C or lowest member of the Petrified Forest formation (Triassic) just above the Chinle D. The non-outcropping formation was there to be prospected by relatively shallow drilling.

Bulldoze 450 Miles of Roads

The prospecting grid was laid out on north-south coordinates 600 feet apart. The first thing done was to bulldoze 450 miles of truck trail along these grid lines. Then the half-track-mounted wagon drills or truck-mounted rotary drills moved along the

roads and put down a hole every 600 feet. Hole depths were determined by geologists.

This drilling proved successful and resulted in discovery of the three Ramco ore bodies. Reserves in the three aggregate 66,635 tons, averaging 2.89 feet in thickness, and assaying 0.365 percent U_3O_8.

On the Arrowhead claims,site of Huskon mines, named after Charlie Huskon, the Navajo Indian permit holder, 10 ore bodies were blocked out by drilling. Ore varies from 1.71 to 4.61 feet in thickness with sizes ranging from 700 to 98,000 tons. Total tonnage is 194,503 averaging 0.322 percent U_3O_8.

Stripping ratios to mine this ore vary from 0 to 12 to 1. Fortunately in the latter instance the ore body is well above average grade. Total stripping for the above tonnage has been calculated at 727,525 tons. These uranium ore bodies are just like those found in the Morrison formation; that is, you can't accurately delimit them and determine true tonnage by any economic drilling method. Mining to date has found channels, rolls, and extensions to several deposits which were not indicated by drilling. Also, deeper lenses of ore have been found at several mines.

Geologic Controls

As mining has progressed, an important geologic pattern appears to be developing which should lead to the discovery of additional deposits. This is an apparent structural control by a series of three fault systems. They strike northeast-southwest, north-south, and northwest-southeast. All have steep dips with small displacements, usually only a few feet. Associated minerals include pyrite, gypsum, and cobalt sulphides and oxides.

The surface of much of the prospected area was covered by blow sand and gravel beds. A special method of drilling was therefore perfected so that expensive diamond drilling with cased holes was obviated. Bentonitic shale was hauled to the holes and mixed with water to form a mud casing around the upper section of the hole. When the hole reached the more competent rocks—clay, silt stones, and sandstones, it was drilled dry with the cuttings blown to the surface for the sample. Gardner-Denver 4-inch rock drills, mounted on 10-foot sashes using jointed steel and 2¾-inch tungsten carbide detachable bits, regularly put down holes as deep as 120 feet by this method. For mobility these drills were mounted with Jaeger 365-cubic-foot compressors on International half tracks.

GRADING ORE with a Gieger counter. Each bucket full or ore is checked with a counter to determine its uranium content. Ores of same grade are then stockpiled together. Each mine will build up several piles, each of different grade.

Navajos Make Good Miners

The open-pit mining is simple. Strip the overburden with company equipment or under contract, then follow the ore. Navajo regulations require employment of Indians and mining of specific tonnage per month from each claim or permit. The Indians fast develop mechanical skills and are trained to operate loaders, compressors drills, and bulldozers. Mining is well ahead of mill demand with stockpiles of various grades available for shipment according to mill requirements.

Rare Metals uses one Caterpillar D8 and one D7 for bulldozing overburden. A 15-yard Carryall pulled by tractor is used for major stripping. Ore is loaded by three International TD 9's equipped with Drott front end loaders mounting a one-cubic-yard bucket. Air for jackhammer drilling is supplied by three Gardner-Denver 125-cubic-foot portable compressors.

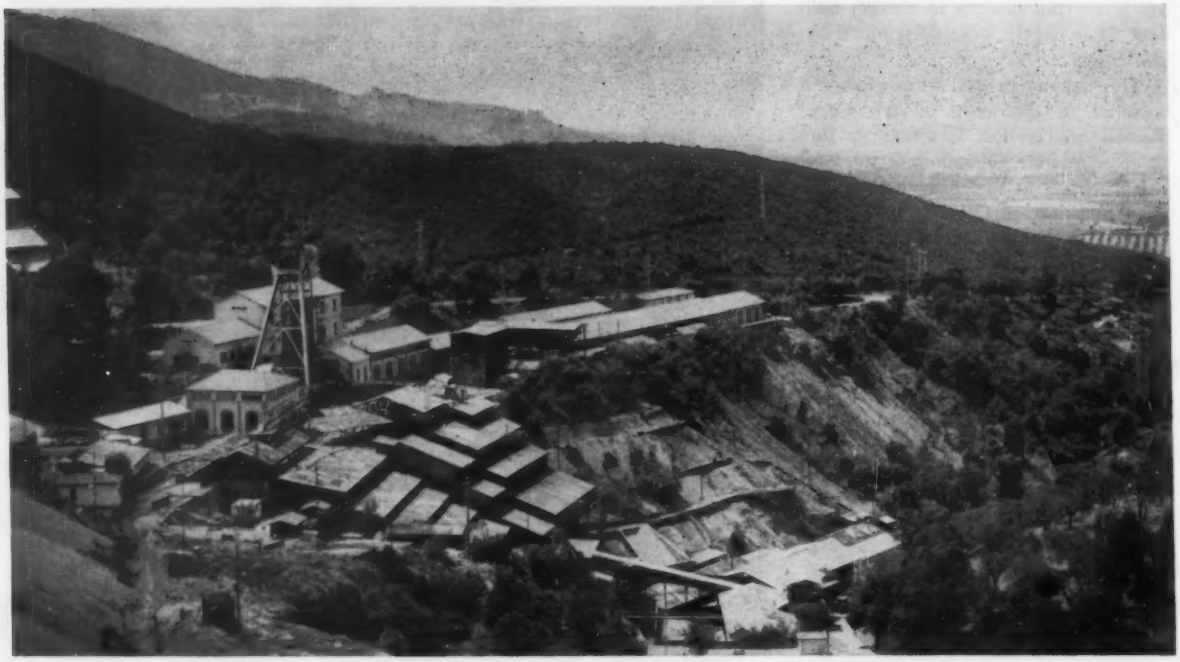
In uranium you can't mine it all with mechanical equipment so the Navajos with pick and shovel are effectively used to mine thin beds, rich pods, and small rolls.

J. C. McFarlane, mine superintendent, left the mountains at Stibnite, Idaho for the Painted Desert to mine uranium. N. R. Baker is mine foreman; William L. Fugate, senior engineer; and Marko Sirovina, junior engineer.

THE END.

HAROLD HORST
Exploration geologist

J. C. McFARLANE
Mine superintendent



SURFACE PLANT of the Gavorrano pyrite mine of the Societá Montecatini a few miles northeast of Fallonica. The mine is near the Tyrolean Coast opposite the Island of Elba. Main shaft at left and mill in the foreground.

A U. S. Mining Professor Takes A Look At The Italian Industry

By LUTE J. PARKINSON

The outstanding impression gained during my recent inspection of major Italian mines and mills was how much the mining industry had achieved through technology during the past decade. The Italian mining industry, while not as large as that of other European countries, has adopted modern equipment and methods which have raised output, and has increased its ore reserves by means of progressive geologically guided exploration.

Since 1938 the industry has increased the tonnage of ore handled on a weighted average by 32 percent. Based on a 1938 production index of 100, recent annual tonnage of metallic ore reached 138 on the index; solid fuels, 121; pyrite and sulphur, 85; and nonmetallics, 240. It must be remembered that in figuring these indexes, pyrite production was 1,290,000 tons in 1955, an increase of 39 percent, but sulphur ore was at 202,000 tons, which shows a drop of 49 percent.

Production of metals from ores increased by 85 percent during the period, as imports of ores increased more strongly than exports.

Mr. Parkinson is head of the Department of Mining Engineering, Colorado School of Mines, Golden, Colorado.

Montecatini's Modern Mines

The great Montecatini Company is the largest single Italian mining operator, and I was fortunate to be able to visit six of the mines it owns and operates, as well as the Montevecchio property in southwest Sardinia in which it has a financial interest. Visits were also made to the Mont Amiata mercury mine and to the Larderello natural-steam power plant.

Montecatini is primarily a chemical concern but it operates a total of 15 mines in Italy to assure its supply of certain raw materials. Like other branches of the company, its mining operations are directed from the head office in Milan and constitute a tightly operated, well controlled branch of the organization.

The mining industry of Italy is not large in comparison with those of several other European countries and I was not prepared to find it as modern in equipment and ideas as it proved to be. At almost every property I visited, one sensed that management was on its toes and that close touch is maintained with the latest developments in the industry wherever these may originate. Active programs of capital expenditure have been carried on for the past several years and have involved replacements and improvements of both underground and surface plant and equipment. As an example, 28 crushers of United States design and British manufacture have been installed at the different properties during the recent past. Plant and equipment of United States, Italian, German, and Swedish origin are to be seen.

Much has been done toward the mechanization of underground operations but the process still has a considerable way to go. The cost of underground labor, including fringe benefits, is approximately $6.00 per shift, so the impelling motive which has hastened the pace in the United States is not present.

BACKFILL for stopes is blown in by compressed air at the Gavarrano mine. Pneumatically spread fill is commonly used in Italy.

Ore Reserves Surprising

Also, I had expected to find that after hundreds or, in some cases, thousands of years of operations, most of the properties would be largely occupied in cleaning up remnants and odd blocks of reserves. On the contrary, nearly all of them are in extremely good shape on this score and not only have several years' supply of ore blocked out ahead of them but the prospects are excellent for extending the reserves substantially. In some cases it seems that, like the Butte, Montana district, the story is only beginning.

Several things might account for this fortunate position. First, the scale of mining in medieval days was unbelievably small as seen through modern eyes. Second, improvement in mining equipment and techniques, with the resultant increase in efficiency, has converted into ore much mineral which previously was not commercial. Third, better methods of exploration are now available for finding and proving extensions to long known ore bodies. Last, improvements in beneficiation methods have been even more decisive in their effect and have not only made profitable the treatment of material which was formerly too low-grade to be commercial, but have made possible the handling of multiple-mineral ores which previously had to be left in place because of their metallurgical complexity.

With one exception, the properties visited were sulphide ore bodies, five of them pyrite bodies. Generally the mining method is some variation of cut and fill, with output on the order of one ton per man-shift underground. At Mont Amiata caving is being tried on an experimental scale and looks promising. Top slicing is used at one mine, and in another instance a longwall system was noted.

The scale of the work is small, according to United States standards. Nearly all hoisting is done by cage,

HOW BACKFILL charge is introduced into the compressed air line. The wheel-mounted hopper has a 9 to 10-cubic-foot capacity; charge is placed in 40 seconds.

DRAINAGE TUNNELS are driven to handle water at several of the pyrite mines. At the Boccheggiano mine (above) the tunnel is 6 miles long.

using small cars of about ¾-metric-ton capacity. Underground haulage is usually by battery locomotives, though at one mine Diesels are in use. Koepe hoists, almost universal in Germany, are not used. Hoisting ropes are mostly of the flat type.

Housekeeping was good in all mines visited; compressed air leaks were conspicuous by their absence; all equipment and piping was well painted; ladderways were in good condition; ventilation was good in all but a few stopes and was mechanical in all but one mine visited. Modern types of adjustable steel sets were fairly common in drifts, and adjustable steel props and caps were observed in stoping operations. The concrete or granite blocks used at the Montevecchio property for lifting circular ore passes and manways through fill were noteworthy.

How Stopes Are Filled

Methods of spreading fill in the stopes are also worthy of mention. Air-operated, self-propelled, mechanically dumped, rubber-tire-mounted cars of 50-cubic-foot capacity probably constitute the most efficient type of equipment for the wider stopes although older, rail-mounted equipment serves very well in the narrower ones. In stopes which are in bad ground, advance is usually by means of over-hand slice cuts running at right angles to strike; here, fill is placed by either of two methods. The first involves the use of a belt conveyor with a high-speed head pulley equipped with radial blades which throw the fill tightly against the back. The other method is pneumatic and involves the placing of a charge of nine or 10 cubic feet of fill in a receptacle from which it is blown into the heading through a 5-inch pipe by compressed air at 75 pounds per square inch pressure. Roughly 40 seconds is required for the placing of each charge.

Drilling is done mostly with airleg machines, using chisel bits with tungsten carbide inserts. At one property single-use, throwaway bits are used but nowhere were forged bits to be seen. Jumbo mounted machines are used in some of the larger stopes to good advantage.

Among the most interesting of the mines visited was the group of four pyrite properties located a few miles northeast of Fallonica, between Rome and Florence. These are located on the Tyrrenean Coast just opposite the Island of Elba. The are linked to a central point at Scarlino by an 18-mile aerial tramway. From there, a six-mile extension of the tramway connects with the port of Portiglioni. In total, these properties produce the bulk of the 1,150,000 tons of pyrite used annually by Montecatini in its acid-producing operations. From the pyrite cinders which remain after removal of the sulphur, some 800,000 tons of Fe_2O_3 are made available to industry and constitute a substantial part of the iron ore units available in Italy.

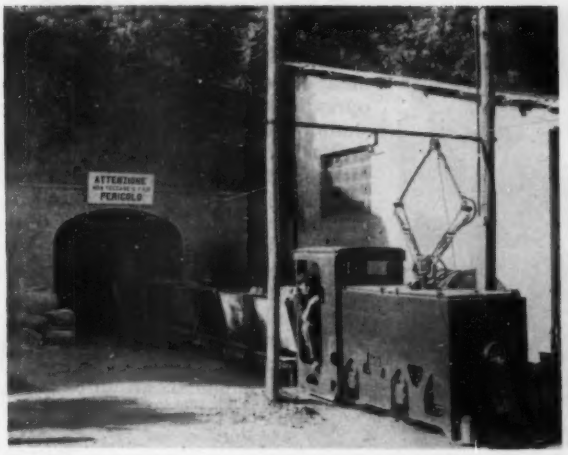
In addition to the pyrite these mines also produce anrually approximately 6,000 tons of pyrite concentrate assaying nearly 3.0 percent copper, and approximately 1,000 tons of lead and of zinc concentrates, the former carrying 1,100 grams of silver per ton.

The greater part of the concentrates is shipped by rail to one of the many Montecatini processing plants and the balance goes by sea from Portiglioni. By the end of this year, as a result of additional milling equipment at the Fenice mine, another 90,000 tons of pyrite will be produced annually, and the amount of lead and zinc concentrate will be doubled.

The four mines have much in common, in addition to the fact that all are mining sulfide ore bodies and have similar mining methods. In each case the mineralization has occurred along the contact of Permian schists with limestones and schists of Eocene age. There are a number of granite exposures in the area and on the Island of Elba, just opposite, and it is thought that the ore solutions were related to this intrusive.

Long Drainage Tunnels

Three of these mines are drained by tunnels driven especially for the purpose, reminiscent of some of the Colorado drainage tunnels except that the Italian ones were driven by the mining company concerned. The one at the Fenice mine, which is 1.25 miles in length, was driven in 1832 when all drilling was by hand. Water is still flowing from it at 2,400 gallons per minute and the project has made available many thousands of tons of ore. The tunnel at Niccioleta is 4.5 miles in length and makes 9,000 gallons. It was driven in what was



PORTAL of the Nicciolete mine shows trolley haulage units in use. Pyrite ore is produced at this mine.

RAIL MOUNTED cars are often used to distribute fill to stopes. This picture was taken at the Fenice (pyrite) mine.

then considered to be the footwall schist and was to drain the flanks of the then known ore bodies. In driving it a number of large, irregular bodies of pyrite were found in the footwall and it was realized that the mineralizing solutions had come up via joint and fracture planes in the schist itself, rather than along the contact of the schist with the younger limestones.

The third tunnel has just been completed to a length of 6.0 miles at the Boccheggiano mine and is making 10,000 gallons. Here, also, the ore bodies of low elevation are being drained and made available for mining.

A new mine may be added to this group because exploration work is being done at the eastern end of the Island of Elba in proving up a pyrite deposit, which may be compared geologically with the other four mines. Considerable equipment has been installed, including a Diesel power plant of 2,400-kilowatt capacity, and a crushing, sizing, and jigging plant which is producing 100 tons of concentrate per day. Several kilometers of tunnel have been driven. While considerable ore is present, the area is heavily faulted and the water problem is expected to be difficult.

Besides the five sulphide properties mentioned, visits were made to the Perticara sulphur mine northeast of Florence and to the San Giovanni di Rotonda bauxite property in the south near Foggia. The first may be representative of the present plight of the Italian sulphur industry, as the ore carries only 22 percent sulphur and is being mined at a loss. Reserves here are of considerable size but surely even a company which feels its social duty to the country as strongly as Montecatini seems to, is not likely to continue operations for many years. Eleven hundred men are employed here and I understand that work is continued in order not to aggravate the unemployment position in the country. Possible improvements in beneficiation methods may improve conditions in the sulphur industry.

The San Giovanni di Rotonda mine is of interest in being one of the few underground operations producing bauxite today. Production is at the rate of 250,000 tons per annum and product runs 54 percent Al_2O_3 with silica at 4.0 percent.

The Montevecchio silver-lead-zinc property on the Island of Sardinia was the last visited. Both the mine and plant have recently been described[1] and no attempt will be made to deal with it here.

My thanks are due to the Societá Montecatini for their generous action in permitting and arranging my visit to their properties. This applies particularly to Julio Rostan, head of the Mining Division, and to Frederico Schmid, the assistant director.

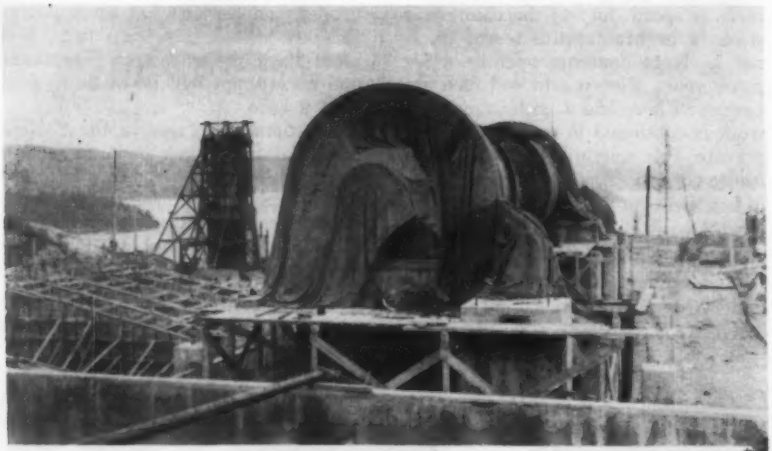
THE END

1. "Lead-Zinc—How Italy's Biggest Producer Plans for the Future," MINING WORLD, July, 1955, by F. Cremascoli and P. Zuffardi.

FLOTATION PLANT at the Fenice mine, which produces pyrite ore containing lead, zinc, silver and copper, shows Denver flotation cells in use.

NUMBER ONE SHAFT at Consolidated Denison's Quirke Lake property in the Algoma-Blind River area, bottoms at 1850 feet. Mucking operations in the five compartment shaft were carried out with a Riddell mucker, speeding up the sinking operations considerably. Initial mining will be carried out through number one, until the completion of a number two shaft now under construction. Two skipways in the shaft contain 9½-ton bottom-dump skips. Butler steel buildings seen at the left are machine shops and a change house. Offices of mine bosses and engineers are in back of headframe.

Here's How Consolidated Denison



THIS IS A PARTIAL view of the grinding plant foundations at Quirke Lake. The lake, as well as number two shaft, may be seen in the background. Two Dominion Engineering Ltd. ball mills are shown partially installed. Pulp from the grinding mill will be pumped uphill to the recovery plant about one-half mile away. Completion of the grinding unit is expected by March 1957. The plant is expected to handle approximately 5700 tons per day, operating seven days per week. The mine producing a larger tonnage will only operate on a six day per week basis.

FOUR-BOOM JOY drillmobiles, with 3¼-inch Leyners are being used to drive a five entry panel, with panels 25 feet wide. Panels will be driven down dip 19° from number one to number 2 shaft connecting them. Mining will be done below 15% grades.

THIS PHOTOGRAPH will give you some idea of the general surroundings at the Denison Camp. The large buildings in the foreground comprise contractor offices, with concrete mixing plant, and steam plant in background.

HERE'S THE FOUNDATION for the hoist installation for number two shaft. The hoists will be required to handle four skips and one man cage. Ore hoisted will consist of a quartz conglomerate containing uranium mineralization in the form of uraninite and brannerite, associated with monazite, magnetite, and rutile. The transformer unit seen in the background, steps down voltage from electrical power economically furnished by "Hydro," the Canadian government utility company. Power purchased from the government is available at a much lower cost than privately produced power.

Readies a 5,700 TPD U_3O_8 Producer

CONSTRUCTION OF the 5700 tons per day acid leach plant is expected to be completed by April 1957. The plant will handle a quartz conglomerate slurry that contains an estimated 0.1 to 0.25 percent U_3O_8, pumped up from the grinding plant. All work on the mill construction is being done by outside contractors, and at the present time 1500 men, both contractors and company men, are employed in the over-all construction of the Consolidated Denison project. All construction material is hauled to the project site by truck from the rail head at Spragge, Ontario, 30 miles away.

THE MAJORITY OF the room and pillar mining method will be carried out with four-boom Joy Drillmobiles and 18-ton rated capacity Joy shuttle cars The shuttle cars load directly onto a main conveyor, leading to number one or number 2 shafts.

NUMBER TWO SHAFT, the main production shaft, is expected to reach a completed depth of 2800 feet by or before June 1957. Owing to close proximity of lake, diamond drill holes are advanced ahead of sinking face to detect any water bearing fissures.

FOR SMALLER PITS this single rear-axle rear dump unit hauls 10 to 15 cubic yards. Good for limited room and short hauls.

BOTTOM DROP unit is used in same ring with rear dump units. This unit dumps on fly and there is no hoist maintenance.

How To Pick The Best Trucks For Your Open Pit Hauling

By C. V. ISBELL

During the many years that we have been doing open-pit stripping and mining, we have never found that "ideal" situation where a pit could be engineered and designed to use competitively just one type and size of hauling equipment. If that "ideal" did occur—and very often, it might make it a little hard to sell our services of contract stripping and mining.

By far the most common situation is that where the original pit plan will require one type of truck for pioneering and early hauling, and perhaps several other types of trucks to complete the development of the pit in the most economical manner possible. Another thing which happens very often is that as the work progresses it becomes necessary to revise the operational plan. In these cases it is sometimes possible to accommodate these revisions by using the same truck unit, but very often money can be saved by using a unit more suitable for the new conditions.

Pits Take Special Trucks

As a general rule, highway type hauling equipment, that which is built primarily for use in cities and on paved roads, is not suitable for most pit operations. Even on jobs where tonnages are not demanding, we have found this type of truck is not capable of continuous uninterrupted operation. Frames give a lot of trouble, or must be modified by 'fish-plating'; tire and wheel sizes normally are too small; in short, the cost of maintenance for this type of truck is such that it cannot be competitive for this type of work. As service units for the mining operations, they have a place, but for production haulage there is better equipment available.

There are a number of manufacturers of trucks for open-pit mining and stripping. They all make models suitable for meeting most of the haulage problems. Let's examine some of this equipment.

The 10- to 15-cubic-yard, two-axle, rear dump truck is well suited to the smaller pits, and for use in the early development or pioneering stages of the larger operations. Where the working room is limited and the hauls are short, this truck is very good.

We like to use the 20- to 25-cubic-yard, three-axle, rear dump truck

TRACTOR SEMI-TRAILER rear-dump unit are good on all hauls but grades must be under 4.0 percent. This unit requires more working space than other units.

Mr. Isbell is president of Isbell Construction Company, Reno, Nevada. Isbell now is contract mining or stripping in Arizona, California, Colorado, New Mexico, Nevada, Utah, and Washington.

REAR DUMP three-axle truck on waste haul in new Montana pit. Can't operate at reasonable cost over short turns.

REAR DUMP truck with three axles has a 32- to 35-cubic-yard capacity. This unit is on waste haul in Arizona copper pit.

where we have ample turning space, so as not to scuff the tires, and good haul roads. It can be overloaded where speed is not a prime factor, but only where heating is not a problem. This truck lends itself to the longer hauls, and, if dumping overboard is necessary, this unit is safer than the two-axle truck.

The 32-cubic-yard, three-axle, rear dump truck is used under nearly the same conditions as the 25-yard. It has more power, carries a larger load faster, and its use is determined by volume to be moved. It has large expensive tires and cannot operate at a reasonable cost on rough roads or short turns.

There is also a 40- to 50-ton, two-axle, 400-horsepower truck using very large tires which should be able to handle steeper grades faster than some of the other units, and again volume may be the prime consideration here. I understand that Kaiser Steel Corporation is using some of these units on a level or downhill haul, but I have not had the opportunity to go into the details of this truck.

Where To Use Bottom Dumps

We use the 15- to 25-cubic-yard, tractor-trailer, bottom-dump units where we can handle good material, dump on top of the fill, and later bulldoze it over. One of the main advantages of the bottom dump is that units can unload on the fly, not losing time on the dump. We prefer, and we believe that costs justify, the use of both large and small bottom dumps, together with a few rear dump trucks in the same ring—the large units on the longer hauls, the smaller units on the shorter and tighter places, and the rear dumps for handling the rock and other material which might not pass thru the bottom dump. The economics of bottom dump use is helped considerably by the lack of hoist maintenance. We avoid the use of bottom dumps, tractor-trailer, or semi-truck units where considerable mud or slipperiness is encountered, or where steep grades are planned.

The 45- to 55-ton tractor-trailer or semi-truck rear dump units are again a large volume consideration, and are equally as good on a short haul as on a long haul, provided there are easy grades (up to 4.0 percent). The trailer-type equipment reduces maintenance on the tractor or earthmover unit because there is not as much strain on the equipment or tires; however, this kind of equipment requires more working space than the short-coupled, rear-dump trucks.

The Place For Scrapers

Although this is primarily a discussion of trucks, I believe that there are many places where other types of equipment are more suitable for pit haulage. On an open-pit stripping job at Boron, California, scraper units are being used to good advantage.

On this particular job, both the trailer-type and the overhung type of scraper are being used. Choice of equipment was determined by the kind of material to be handled and the size of the pit that was planned. The length of the hauls in this instance was not a determining factor. The trailer-type scraper handles better on the longer hauls, and instills more operator confidence, but, on the other hand, the overhang type is better able to get out into the sand and build road for the other units.

Certain pit conditions call for combinations of haulage systems—trucks to conveyors, or to railroads, etc. These combinations have a definite place in the engineering of a pit for the best possible economic end results and should be considered in any plan.

THE END

SCRAPER UNITS are used to good advantage in many places. Overhung unit in foreground has 25-cubic-yard heaped capacity. Trailer type 21-yard unit in rear.

Uranium Still Tops For Miners

All Sessions at Colorado Convention Packed To Hear About Ambrosia Lake And Milling With Other Papers on Thorium, Lead, Zinc, Gold, and Tungsten

Uranium dominated the 60th annual convention of the Colorado Mining Association at its National Western Minerals Conference in Denver, Colorado in mid-February. This isn't anything new as uranium has dominated this and other meetings for several years. But it was a different phase of the uranium industry—ore processing—that dominated instead of geologic settings, exploration methods, or guides to prospectors.

Uranium milling is complex; new processes are being developed to make the newest mill obsolete before it gets into full production, and milling rate is still growing with several additional large tonnage plants about ready for construction.

Listening to both the technical papers and conversational groups, one heard for the first time such terms as "three laminar layer continuous phase disengagement of the carrier," or "uranium extraction factor of the multistage counter current contact system." This is only part of the new uranium language. And, most importantly, this will soon be the language of a growing segment of the metallurgical industry because the vast sums of money poured into uranium extraction and recovery produced results now being applied to other metals as this typical conversation indicated "What was your experience in liquid separation of tungsten?," or "did you try zinc recovery with both anions and cation resins?"

See High Uranium Power Use

Those mine operators who have viewed the rapidly expanding uranium production with a certain amount of trepidation due to the uncertain market outlets when and if the government decides to step out of the picture, must have found a great deal of comfort in the remarks made by Atomic Energy Commissioner Willard F. Libby. He said that it has been predicted that electrical power consumption will double every 10 to 15 years. By 1975 nuclear power capacity in the United States may reach 50,000,000 to 70,000,000 kilowatts if nuclear generating plants prove to be competitive with other forms of power plants. Present reactor designs generally require the equivalent of between 0.2 to 2.5 tons of natural uranium for each 1,000 kilowatts of installed capacity.

Reasonable assumptions, continued Mr. Libby, lead us to expect that the cumulative uranium oxide requirement by 1975 for the United States

OUTSIDE EXHIBITS featured drilling, loading, and haulage units. Here is one of the Winter Weiss uranium drills.

alone can reach 75,000 to 100,000 tons; and the annual requirement for that year might be in the range of between 20,000 to 30,000 tons of concentrate. Compare this to the 1956 production of 6,000 tons and the 1958 production goal of 15,000 tons of concentrate per year. Chances are that the need for nuclear power generation in foreign countries will be considerably greater than in the United States, so that the free world requirement for concentrate may approach 40,000 to 100,000 tons per year in 1975. This compares with an estimated free world production of 30,000 to 40,000 tons of U_3O_8 in 1958.

Mr. Libby brought out the fact that present and near future demand for U_3O_8 is mostly military now, but stationary reactors for electrical power and reactors for ship propulsion will provide the new non-military requirement. The bulk of the uranium consumed by the new market will be used to build up reactor fuel inventory. Following this, a lesser amount will be needed to replace the fuel consumed each year. Also breeder reactor design may contribute toward the supply of fissionable material for initial inventory of other reactors.

Ambrosia Lake Still Grows

It was just one year ago at the Colorado Convention that the first public disclosure was made of the "true magnitude and significance of the Ambrosia Lake district." Ambrosia has made uranium history since, has virtually ended United States dependence on foreign sources of uranium, and has become another important chapter in the long book of successful stories of mineral discovery and development in the United States when an incentive is present.

Richard T. Zitting, geologist for Kermac Nuclear Fuels Corporation, Grants, New Mexico, updated Ambrosia developments as he reported that Kermac Nuclear, composed of Kerr-McGee Oil Industries, Inc., Anderson Development Corporation, and Pacific Uranium Mines Company, has developed the following reserves: proven, 14,000,000 tons; probable 9,000,000; and potential, 9,000,000. Average grade: 0.32 percent U_3O_8. Other companies had total reserves of 15,000,000 tons assaying 0.27 percent. He added that the ore had been found over an eight-mile length and that the southeast trending ore body might reach a 10-mile length. Kermac has drilled 1,615,000 feet of hole at a cost of $2,000,000 to develop its ore.

Edward P. Chapman, Jr., member of the Albuquerque, New Mexico consulting engineering firm of Chapman and Wood, outlined the "Drilling Problems and Experiences in the Ambrosia Lake Area" which developed this ore body. He outlined the problem of proper evaluation of deep drill holes by radiometric logging. He then compared radiometric and chemical assay results for a deep hole and

showed slides to illustrate the method of making an evaluation summary.

No Long Range Program Ready

One of the biggest disappointments of the convention was that no word was forthcoming on the status of the Interior Department's long-range mineral program. Referring to tungsten specifically, and other minerals in general, Senator Alan Bible of Nevada said that we must chart a course for the mining industry and stop living on stop-gap programs. This sentiment was echoed by Senator Arthur V. Watkins of Utah. Discussing the problems of the mining industry, Senator Watkins said that the solution appears to be the formulation and passage of legislation establishing long-range policies for preservation and continued operation of our domestic mining industry. The President, said Senator Watkins, has promised to send specific recommendations for such legislation early this session of Congress. He said that when the proposed long-range bills reach the Congressional hoppers and come before the Senate Interior Committee, "I plan to request that hearings be held at a central place here in the West, so that we can have the benefit of the thinking of you people who have to meet the day-to-day problems of the prospector and miner."

Will Call Western Hearings

If long range mineral legislation is not forthcoming during the present session of Congress, Senator Watkins proposes to re-submit an amendment to H. R. 1, the 1955 bill to extend the Reciprocal Trade Agreements Act. This amendment proposes a return to the Congress of substantive control over escape clause proceedings under the Reciprocal Trade Agreements Act.

Continued Senator Watkins, if such action doesn't appear warranted then the least we can accept is adequate tariff protection for critical raw materials.

Assistant Secretary of Interior, Felix Wormser, immediately following Senator Watkins address, said that, "I can't present the long-range mineral program today." He pointed to the need for developing a workable program which must take into account the defense of the nation, sound fiscal measures, and friendly relations with countries abroad. Any Federal mineral program said Mr. Wormser must square with these and other areas of government interest, and the President must examine any proposed mineral policy most minutely and carefully before giving his blessing. In spite of a great deal of hard work by all the

NATION'S TOP TECHNICAL SPEAKERS came from all parts of the United States to speak on 153 subjects. Note how the crowd is paying strict attention to the speaker just to right of point where picture was taken.

LOST CREEK OIL & URANIUM operations in Wyoming were presented by Robert Adams, president. H. Balsley, Moab, is on the left.

IRON ORE PREPARATION methods were detailed by H. E. Rowen, McDowell Co., and R. R. Williams, Jr., manager, CF&I Corp. mines.

AMBROSIA LAKE discoveries were told by Santa Fe's Tom Evans (left), and Kermac Nuclear Fuel's Richard T. Zitting.

COLORADO MINE MANAGERS who spoke were Barney Greenlee, Resurrection (left), and A. C. Hilander of Idarado.

MILLING SECTIONS speakers from left were: Harry Culver, Rocky Mt. Standards; Leigh Jones, Western Machinery; John Nason, COG Minerals; Ralph Toerper, Climax Uranium; Paul Cardwell, Dow Chemical; Keith Brown, Oak Ridge Laboratory; J. B. Rosenbaum, U. S. Bureau Mines; and C. J. Lewis, Colorado Mines Research.

SOWBELLY ON THE HOOF. Grand champions all, specially shipped by Colorado from Minnesota for the Sowbelly Dinner which ends the National Western Mining Conference. Speaker was Brig. Gen. Clyde H. Mitchell on "Minerals in Air Defense."

available staff, nothing is yet firm enough with regard to the Interior Department's long-range mineral program.

Mr. Wormser pointed out that some of the strongest pressure for a long-term mineral program came from within that segment of the mining industry which is confronted with immediate or short term problems. He said that with respect to these immediate problems it was his feeling that few within the mining industry have actually suffered during the past four years. Then he pointed to the record of the present administration in providing encouragement and assistance via military stockpiling and supplemental or barter stockpiling.

Otto Herres, chairman of the national Lead and Zinc Committee, outlined clearly what his group thought the minerals policy should be. He said, "We trust that the Administration's long-range minerals policy will carry on the American tradition of individual and local independence. The role of government should be to create an atmosphere within which private industry will be permitted and encouraged to thrive and play its part in the national development."

Iron Sintering Grows

One of the most important iron-range trends in recent years is the demand for a tailored blast furnace feed, according to H. E. Rowen, general manager Dwight-Lloyd division, McDowell Company, Inc. He traced the development of methods for producing high-quality iron-ore sinter for blast furnaces using Dwight-Lloyd sintering machines. One interesting fact pointed out by Mr. Rowen was that sintering practice has provided additional blast furnace capacity for about 10 percent of the cost required for new or expanded furnace facilities. Lead metallurgy exerted an influence on iron ore sintering practice; methods now used for Minnesota taconites and Michigan flotation concentrates are similar to those employed for eliminating sulphur and sintering lead concentrates for furnacing. Dwight Lloyd machines accomplishing this function are employed in both industries using either up-draft or down-draft sintering. Because iron ore lacks the sulphur associated with lead concentrates, fuel must be added to the granular, upgraded product of beneficiation plants. This has been accomplished with the well publicized flying saucer developed by the McDowell Co., Inc.

Later in the day W. H. Young, manager, Chemical Metallurgical Division, Sherritt Gordon Mines Ltd., described hydrometallurgical developments at the company's Fort Saskatchewan nickel refinery. A workable process was first developed in 1950 utilizing two-stage, counter-current, pressure leaching. Today the plant is producing approximately 30 tons per day of powdered nickel.

PICK LABORATORIES set up by Vernon Pick, discoverer of the famous Delta uranium mine in central Utah, displayed its new prospector scintillation instrument with an automatic altitude correction. Mr. Pick is at the left.

First Report On Pima

Pima Mining Company started milling copper ore from the newly developed open pit south of Tucson, Arizona in December 1956, said Paul Allen, vice president and general manager of the company. Nominal capacity of the concentrator is 3,000 tons per day, and the well designed plant features minimum labor requirements resulting in a high tonnage per man shift. The pit, developed in an area of flat relief, will be quite deep. To cut down on adverse haulage grades when ore is taken from the pit, the company is using the Rockover skip system developed by National Iron Company. The incline for the skipway is 38°; 22-ton capacity skips are hoisted by a double-drum Nordberg hoist.

Look To Commercial Market

Jesse C. Johnson, director, Division of Raw Materials, United States Atomic Energy Commission, reported that government needs for uranium in the last nine years were continually revised upward. He then said, "However, it is my opinion that the uranium industry should now study the potential commercial market and look to that market for its main supply after 1966." He also gave, for the first time, the reserves of Anaconda Company's Jackpile mine in New Mexico ". . . estimated to contain at least 15,000,000 tons of 0.16 percent U_3O_8 ore, still the largest single uranium deposit yet found in the United States."

Officers for 1957

Officers elected were: G. T. Rummel, La Salle Mining Company, Grand Junction, president; Max W. Bowen, Golden Cycle Corporation, Colorado Springs, first vice president; Walter E. Burlson, consulting engineer, Salida, second vice president; D. W. Viles, Vanadium Corporation of America, Durango, third vice president; and Frank Coolbaugh, Climax Molybdenum Company, Golden, fourth vice president. Re-elected were H. W. C. Prommel, treasurer, and Robert S. Palmer, executive vice president.

Mining World Establishes Annual Awards

As Recognition For Fine Work That Companies and Engineers Are Doing For the Advancement of All Minerals Sciences

MAN OF AMERICAN MINING was John B. Knaebel, Anaconda's uranium expert. Albert Fitch, Jr. accepts Mr. Knaebel's award from George O. Argall, Jr., MINING WORLD Editor.

UNDERGROUND MINE plaque accepted by Harry McNeill for San Manuel Copper.

MINING HALL OF FAME showing the seven special plaques presented by MINING WORLD to the companies and men who did so much for the industry in 1956.

SMALL MINING COMPANY award to Rare Metals Corp. is accepted by Mitchell H. Kline.

OPEN-PIT MINE of 1956 was Anaconda's Berkeley with A. C. Bigley taking plaque to Butte.

TECHNICAL ACHIEVEMENT was solvent extraction work of Keith Brown, Oak Ridge Laboratory; Bruce Clemmer, Bureau Mines; Richard Dow Chemical.

It's Iced Water For Desert Rats!

How many of you old desert rats remember the flax or canvas water bag? Everyone of you were lucky to have water of any kind and the water bag was your most important possession. Remember how you scraped the dirt and slime off the bag before hoisting it over your head and taking a good swig. How the bag gave the water its own sweet taste.

Well, today it's different—the water bag has gone the way of the Burro for the modern prospector. Times have

changed with the Jeep replacing the Burro and uranium prospectors drinking iced water from paper cups.

The picture shows a Rare Metals Corporation of America Jeep on the Painted Desert of northern Arizona. Those two galvanized metal containers on the back are filled at camp each morning with chunks of ice from the ice machine. If you want a drink, take a paper cup from the dispenser on the side of the Jeep, turn on the faucet and you have fresh, clear ice water.

What will they think of next?

Issuing Small Warehouse Items

Warehouse supplies costing less than $0.50 each, while representing less than 5.0 percent of the dollar volume, necessitated over 50 percent of the supply issue requisitions at International Minerals and Chemical Corporation's Noralyn, Florida mine and mill.

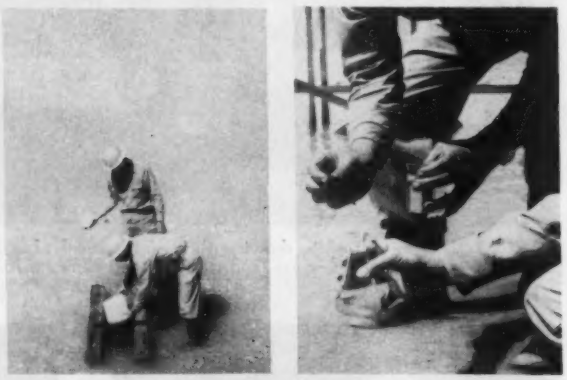
These small items, numbering in the hundreds, included nuts, bolts, washers, nails, fittings, etc. Formerly it was necessary to prepare a requisition for each item, have it approved by a supervisor, and present it to stock room clerk for issue. This meant that the cost for warehousing, controlling, issuing, and accounting for such items was more than their value.

A study showed that money could be saved and supplies obtained faster by placing all such items in open bins where accountability of each item was not required. These bins are revolving steel trays so that warehouse clerks can keep them filled from stores area and the mechanics etc. can simply revolve the bins to select any small items needed.

How To Prevent Water Evaporation

Water conservation is of great importance to mill operators in the Southwest. The Metallurgical Department of Kennecott Copper Corporation's Chino Mines Division at Hurley, New Mexico has the responsibility for water supply and conservation.

As another step in the continuous search for better ways to conserve water, the Metallurgical Department is testing a method of coating water reservoirs with a film of cetyl alcohol which is expected to reduce the waste of water by evaporation. The cetyl alcohol comes in white cakes and is placed in floating containers in the water. The wave action gradually wears off the corners of the cake and forms a perfectly round disk. Tests at Axiflo Lake and at some of the other reservoirs show that the entire surface is covered with the film. Future measurements of the water evaporation rate will determine how effective the material is.



CETYL ALCOHOL FILM on surface of water reservoirs to prevent evaporation is tested at Chino Mines Division of Kennecott Copper Corporation. Tom Tipolt and Oliver Newell, at left, place a new cake of Cetyl alcohol in container on water surface. At right, the film is detected by use of red indicator which spreads over the film surface. *Kennecott Chinorama* photographs.

Other chemicals being used to produce a "mono-film" to prevent evaporation include hexadecanol, peanut oil acid, ground plastic, plastic bubbles, ground cork, and plastic membranes. A common feature of such one-molecule-layer-forming compounds is that they will feed out a one-molecule-thick layer over the water surface until the substance is completely dispersed. Under ideal laboratory conditions hexadecanol will prevent 99.9 percent of the evaporation. Theoretically, 1/100 of a pound will cover one acre of water surface with a one-molecule-thick layer. Ed.

Muriel Sibell Wolle Describes

RHYOLITE: CONCRETE GHOST IN THE AMARGOSA DESERT

The mountains around Rhyolite, Nevada look much as they did in August 1904, when Shorty Harris trudged across Daylight Pass from the Keane Wonder mine, looking for a quartz blowout that he had once seen but had not investigated. With him was Ed L. Cross, a prospector, whom Harris had found at the Keane Wonder. It was Indian country, known only to a few prospectors like Harris, yet within two years gold fever was to transform the area close to the Bullfrog Hills into a mining center known from Wall Street to San Francisco.

Shorty had prospected since 1878 but had never struck it rich; this time his pick broke open rock sprinkled with free gold—"the original genuine green bullfrog rock" that he described to cronies in Goldfield where he and Ed went to celebrate. Shorty told a few people about their discovery and, while drunk, sold his half interest for $800. Cross kept his and disposed of it later for $60,000.

"Old Man Beatty," a rancher on the Amargosa, heard of the strike and went over to the Bullfrog Hills to gopher around. He located the Mammoth claim. At about the same time Bob Montgomery (or Shoshone Johnny—accounts differ) located a mine about three miles away from the initial strike. Some say Indian Johnny, whom Montgomery had grubstaked for some time, found the mine and agreed to trade his prospect for a pair of overalls.

Because of these discoveries, the rush to the Bullfrog district commenced in the fall of 1904. New strikes were made and prospectors were soon combing an area 15 miles long and 10 miles wide. As men poured into the desert, townsites were laid out—tent cities called Bullfrog, Amargosa, Jumpertown, and Bonanzo. The *Los Angeles Mining Review* of May 27, 1905 prints the impressions of one reporter as follows:

"I had the curiosity to go see an absolutely new mining camp so I went to Bullfrog . . . a place of two or three tents. . . . Before we were within four miles of the original discovery you could see location monuments anywhere and everywhere. And of all the rigs you would see men going down there in! . . . Wagons breaking down all along the line. Everybody bound for Bullfrog. . . . The first thing that struck my attention . . . was to see a bar right out in the open, with God's blue sky for a ceiling and the surrounding sagebrush for walls. . . . The Amargosa River, which you can step across at any place, and out of which they expect to develop water to mill the ore, offers some possibilities, it sinks and rises, sinks and rises."

Amargosa townsite was near the camp of Bullfrog. Bonanza was near the Montgomery-Shoshone, Denver, and National Bank properties, three miles east of Bullfrog. Early in 1905, the owners of several other mines laid out a new townsite between Ladd and Bonanza Mountains and called it Rhyolite. This settlement soon absorbed Bonanza, a mile away, for Rhyolite boosters went to the residents of Bonanza and offered them free lots in the new townsite. The men in Bonanza agreed to abandon their camp and moved everything up to the new site in one day. Even Amargosa and Bullfrog camps were moved bodily to the flat below Rhyolite and became known as Bullfrog No. 2. Gold Center sprang up on the desert four miles south of Rhyolite and was for a time the railhead for the larger town. Beatty, five miles away, grew up beside the Amargosa River.

Stage fare from Goldfield was $18; auto fare was $25 one way. The first shipment of whiskey that was hauled in from Goldfield was met on the road by thirsty men, who bought and immediately drank the entire stock. Ice was also trucked in from Goldfield and was paid for by the pound, having been weighed when loaded. Often only a small lump survived the long, hot trip. Until pipelines were constructed to the camp, all water was hauled from Beatty in whiskey barrels and peddled at from $2 to $5 a barrel from

Rhyolite's concrete rises out of the Amargosa desert.

door to door. Each tent had its storage barrel.

By 1906 the town was booming and had a population of 10,000. Two railroads, the Tonopah and Tidewater and the Las Vegas and Tonopah were racing across the desert to reach it. The Las Vegas and Tonopah, the first to arrive, was sponsored by the Honorable Wm. A. Clark. The first passenger train reached Gold Center on October 12, 1906. The first train into Rhyolite arrived December 14. The city's pride is expressed by the *Herald* of Dec. 21:

"The first week of railroading . . . has been a rather strenuous one. . . . By the end of the week, 100 carloads of freight will have been landed here . . . freight has been accumulating on sidings . . . waiting to be moved to the metropolis of the Bullfrog district. The Rhyolite sidetracks have a capacity of 105 cars. Cars have been coming in steadily until the capacity is exhausted, the work of construction interfering with the free use of the tracks. . . . The company's passenger station is the finest in the state. . . . It is a pleasure indeed to say goodbye to the old Concord stagecoach and to the 'halfway' stations along the way, and step into a Pullmann palace car and travel with comfort and ease."

The greatest mine was the Montgomery-Shoshone. Not only was its stock handled by the New York curb market but Charles M. Schwab invested in more than $2,000,000 worth of its stock. He also financed a $500,000 reduction plant whose mill was the largest in the area. The National Bank, Gibraltar, and Homestake mines on Ladd Mountain were well known properties, as were the Hobo, Sidewinder and Denver on Bonanza Mountain. These last three were eventually combined as the Tramp Consolidated. Stock sold during the boom at $3 a share on the New York curb. The following notices were found in an old water-soaked scrapbook, picked up in Rhyolite, years after the mines lay idle.

"Bonanza Mt. Gold Mining Co. . . . all of the Bonanza Mt. properties under development have proved to be a series of parallel veins of strong character, well defined and of great depth. Taylor & Griffiths, brokers, Rhyolite, Nev."

"Feb. 9, 1906. T. L. Oddie, Sherwood Aldrich, et al, have scooped in more of Bonanza Mountain. They have taken an option this week on 500,000 shares of Denver Annex stock which means the control—the price stipulated being ten cents a share."

All during 1906 speculators and brokers were active, aided by extravagant advertisements which assured good returns to all investors. Each camp had its own stock exchange to handle local transactions; money was so plentiful that quarters were the smallest coins seen. George Graham Rice, one of Rhyolite's promoters, describes this period in his book "My Adventures With Your Money" and admits making $20,000 in one day by skillful sales of stocks and town lots.

By the end of the year the mines, whose surface ores were exceedingly rich, had produced $3,000,000. Everyone was optimistic for if values increased with depth, the district's boom was just beginning. By 1907 the population was conservatively estimated at 12,000 (and commonly reported as 16,000). Senator Stewart had built a house at one end of the town and had opened a law office. Substantial concrete and stone business houses replaced tents on Golden Street, the most pretentious of which was the $90,000 John S. Cook block on the corner of Golden Street and Broadway.

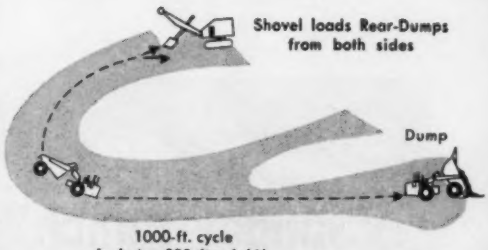
During the winter of 1909 the *Herald* boasted: "four years after the Bullfrog excitement started, finds the district enjoying the greatest prosperity in its history, from a standpoint of ore production and mine development. During the year 1908 the district marketed close to $1,000,000 worth of gold-silver ores and bullion, and this was the first year that conditions had been favorable for production. The Montgomery mills are working steadily, treating 4,000 to 5,500 tons of ore a month. In addition to the ore treated by the local company plants, direct shipments were made from the Diamond Queen, Bullfrog Pioneer, Tramp Consolidated, Bullfrog National Bank, Diamond Consolidated, Capricorn, Little Lee and Bullfrog West Extension, bringing the total production, according to the best information obtainable, above the $900,000 mark. The outlook for a large production during the year is flattering in the extreme, and it is believed by many that the year's production will not fall short of $2,000,000 and perhaps reach much higher."

In spite of such predictions mine after mine closed down. In 1910, the population dropped to 700. The Montgomery-Shoshone Company stopped drilling and, with the largest property idle, people began to pull out, leaving houses and offices fully furnished. Only one room was used in the big new schoolhouse, for the 18 children still in town. Finally, the last train chugged out and a salvage crew took up the rails and loaded them on flat cars.

For the next 25 years Rhyolite was deserted, except for an occasional prospector. Buildings sagged and roofs caved in. Desert sand drifted around walls and desert plants grew in the streets and pressed against foundations. By 1923, most of the wooden buildings had been moved out or razed and even the floors had been ripped from the largest concrete ruins.

In 1938 Mr. Westmoreland bought the town at auction and turned the pretentious railroad station into a saloon. Today the depot (called the Rhyolite Ghost Casino) and the Bottle House (now a museum) are the only inhabited buildings. The larger concrete structures, including the three-story bank, have been dynamited, leaving only jagged, roofless shells with gaping windows through which the red, green and ochre stratas of the Bullfrog Hills are visible. Rhyolite, on the edge of the Amargosa desert, whose life span was six lusty years, is not just a ghost town, it is a bleached skeleton.

Haul heaped loads over slippery clay footing at Georgia Coating Clay Co. Pit



1000-ft. cycle
Includes 200 ft. of 6% uphill grade to dump

Within the year, Georgia Coating Clay Co. will produce 90,000 tons of kaolin at Pit #5, one of their 5 mines located in the vicinity of Macon, Georgia, in southeastern U.S.A.

At this pit, 11 miles east of Macon, a 1½-yd. Koehring shovel and two 11-ton D Tournapull Rear-Dumps are stripping a 25-ft. layer of sand and red clay to expose rich kaolin deposits.

Hauls 7 yds. per load

Shovel operator heaped 7 yds. of overburden into Rear-Dump's wide (5 ft. 10½ in.) bowl in 1 minute, 7 seconds. Although rains made clay haul roads wet and sticky, each Rear-Dump consistently hauled heavy loads 500 ft. to the dump site in an average of 1 minute, 24 seconds. Haul included 200 ft. of 6% uphill grade out of the pit. On the dump, the "D" backed in, spotted and dumped in 8 seconds. Then, it pulled away and returned over the same slippery haul road to complete a 1000-ft. cycle in an average of 3 minutes, 49 seconds.

According to Mine Supt. Frank Fountain, when the clay road was dry, the Tournapull Rear-Dumps reduced cycle time to 3 minutes and increased production at the pit by one-third.

"Outstanding in rock"

Tournapull Rear-Dumps were moved to this tough stripping assignment, at Pit #5, after they profitably stripped 90 ft. of overburden at Georgia Coating's other pits. Fountain said, "We were in trouble at this pit until we got these Rear-Dumps. They did outstanding work in both tough rock and 'water sand'. I like them because they are easy to maneuver in and out under a shovel, and they can pull themselves out of soft fill easily, too."

"D" scraper, valuable pit tool

Georgia Coating also uses a D Tournapull scraper on exploratory stripping operations. Besides stripping, this versatile scraper loads, hauls and spreads sandy topsoil over the slick clay haul roads to speed hauling operations.

Tournapull Rear-Dumps are available in 3 sizes: 11, 22, and 35 tons. All can be interchanged with other trail units for year 'round specialized work. Call or write for full specifications.

At a flip of a switch, operator activates an electric motor to raise the Rear-Dump body into dump position. Streamlined bowl sheds material fast and clean.

Stripping 25' overburden, shovel operator easily heaps good load into Tournapull Rear-Dump. Low rear-entry permits quick swing-out of empty dipper with door open.

D Tournapull scraper self-loads, hauls, and spreads topsoil over slippery roads to provide better traction for the heavy haulers on their frequent trips between shovel and waste dump.

Tournapull—Trademark Reg. U.S. Pat. Off. DRDP-1059-Q-bw

LeTourneau-WESTINGHOUSE Company

Peoria, Illinois

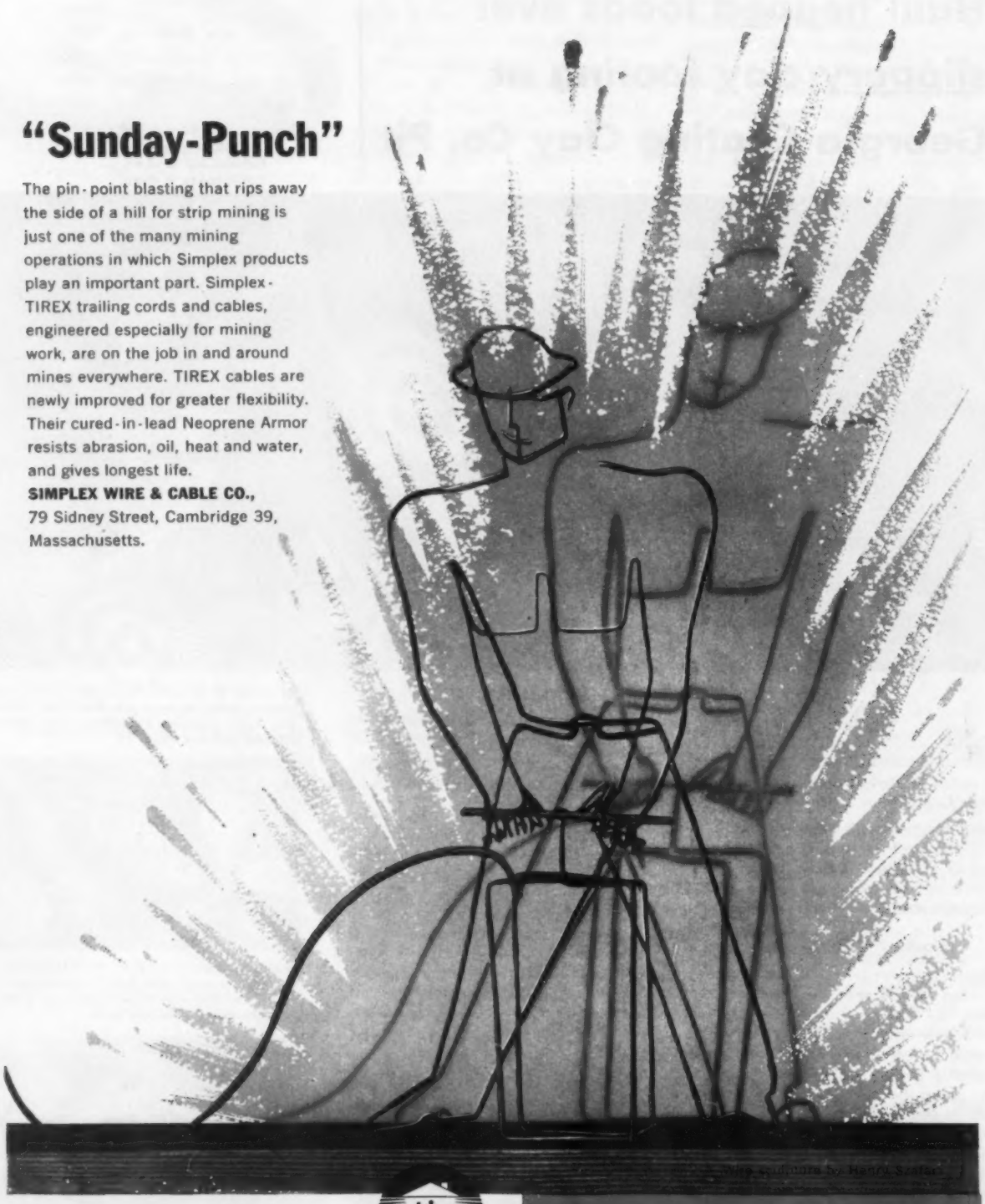
A Subsidiary of Westinghouse Air Brake Company

WHERE QUALITY IS A HABIT

"Sunday-Punch"

The pin-point blasting that rips away the side of a hill for strip mining is just one of the many mining operations in which Simplex products play an important part. Simplex-TIREX trailing cords and cables, engineered especially for mining work, are on the job in and around mines everywhere. TIREX cables are newly improved for greater flexibility. Their cured-in-lead Neoprene Armor resists abrasion, oil, heat and water, and gives longest life.

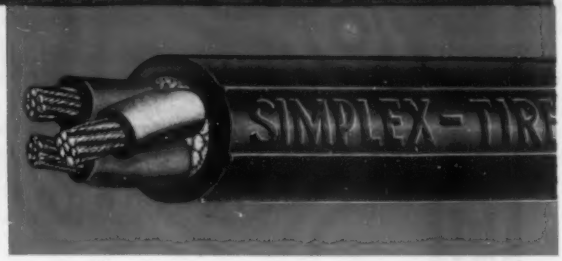
SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Massachusetts.



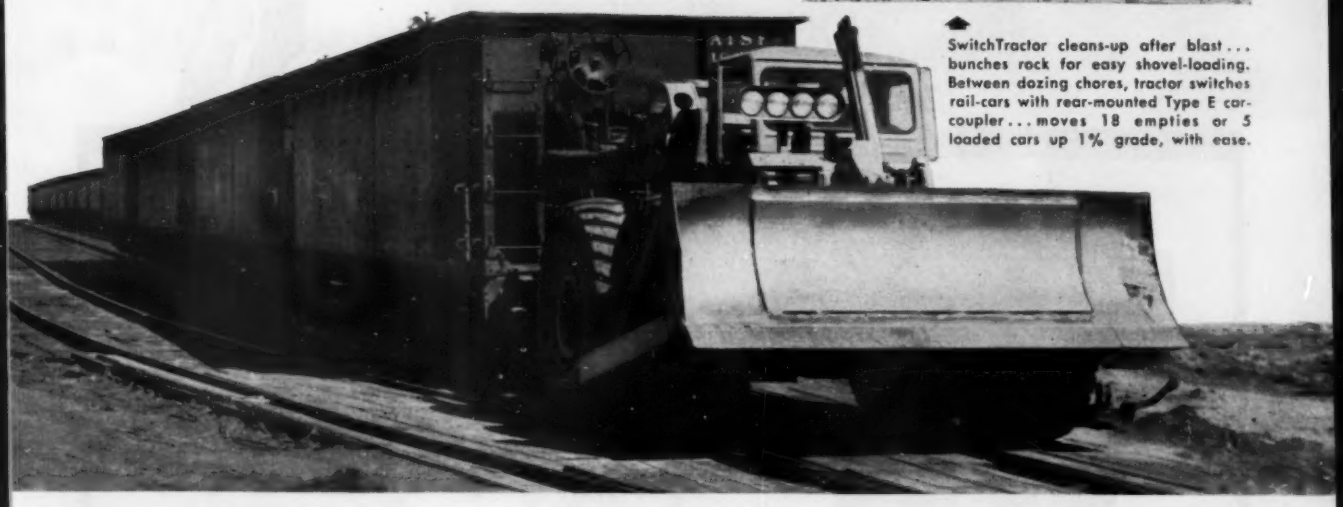
LIVE BETTER ELECTRICALLY

Simplex

TIREX



Double-duty tractor



SwitchTractor cleans-up after blast . . . bunches rock for easy shovel-loading. Between dozing chores, tractor switches rail-cars with rear-mounted Type E car-coupler . . . moves 18 empties or 5 loaded cars up 1% grade, with ease.

SwitchTractor moves rail-cars, does regular tractor work

Here's a big, 208 hp rubber-tired tractor that does double-duty by also switching railroad cars. With its 17 mph speed, and go-anywhere mobility, SwitchTractor works fast . . . often switching "for free" in spare time between tractor chores.

Tournatractor with car-coupler

Cost-cutting SwitchTractor is a regular LeTourneau-Westinghouse Tournatractor—fitted for operation of dozer, angledozer, snow plow, and other attachments. In addition, it is equipped with a standard Type E railway coupler attached on the rear. SwitchTractor can either *pull* a string of cars with its coupler . . . or *push* them with dozer blade; can safely spot or "hump" cars on many widely scattered tracks in a minimum of time.

Switch-engine, not tied to tracks

This 208 hp go-anywhere switcher-dozer is always ready to shift rail-cars wherever needed. Rolling on big rubber tires, it maneuvers quickly from spur to spur . . . moves back and forth between pit, bench, stockpile, plant, dump, or other location. It travels via roads or cross-country . . . always takes the fastest route.

When switching cars, SwitchTractor straddles the rails (6'4" between tires), rolls on tie-ends and ballast. It gets better traction, can *pull twice as many cars* as an on-track switcher of the same weight. Big, low-pressure tires do not damage ties, rails, switches, or pavement.

Saves time on tractor work

Double-duty SwitchTractor also dozes, pulls, and pushes faster than crawlers. Practical work-speeds to 7.5 mph, and top-speed of 17.2 mph, let you handle more plant clean-up and pit maintenance. You build and keep haul roads smoother, open snowed-in roads earlier. You handle shovel clean-up promptly and effectively, spread waste on dumps faster, move utility equipment easier.

On push-and-return work SwitchTractor's constant-mesh transmission with air-actuated clutches, alone, gives you up to 8 minutes extra production per hour. It saves up to 5 seconds, each gear-shift . . . makes no stops for shifting, loses no momentum . . . changes direction or gear-ratios *instantly*. In addition, torque-converter (standard equipment) provides uniform and most effective engine speed — with automatic rationing of wheel speed to load — for maximum efficiency in application of power.

Go-anywhere mobility widens work-range

Because 17 mph SwitchTractor *travels job-to-job twice as fast* as crawlers, it works more productive hours per day . . . services more pit operations, gets to work faster, handles more work over a wider range of travel. It requires no special planking for moves . . . no flatbed-hauler, trucks, and extra help.

This rubber-tired L-W SwitchTractor is a two-way money-saver for mine, quarry, or pit. Call or write for complete details and prices.

SwitchTractor—Trademark; Tournatractor—Trademark Reg. U.S. Pat. Off. ST-1355-M-h

The Bowling Champ
buys a custom-made ball
because he gets
something **EXTRA**

the profit-wise operator

BUYS TRAYLOR TC GYRATORY CRUSHERS for the same reason

Traylor TC Gyratory Crushers are Traylor-made in 7 sizes with feed openings from 20″ to 60″ . . . capacities range from 1240 to over 32,000 tons per eight-hour day. For complete capacities, specifications and descriptions, send for Traylor Bulletin No. 11–120.

TRAYLOR ENGINEERING & MFG. CO.
922 MILL ST., ALLENTOWN, PA.
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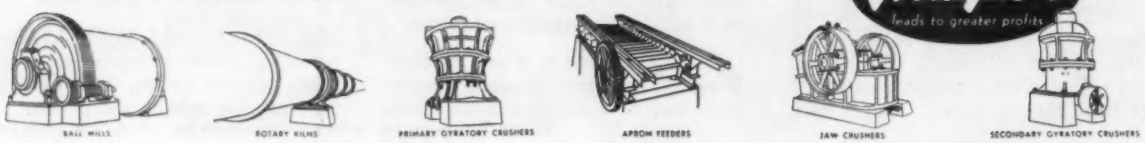
the experts agree . . . there's nothing like

TRAYLOR-MADE

equipment for peak performance

Traylor leads to greater profits



Adams' extra-fast back-up speeds (to 13 mph) save time on one-way work in restricted areas. This "550" can make 5 shuttle "passes" in the time most other graders take to make 4.

Why 15 speeds

in a motor grader?

Because with this wide range of effective speeds you can do more pit and haul-road grading with each machine . . . boost production while cutting costs. 15 combinations of power and speed enable you to make deeper cuts, push bigger loads, work and travel faster than ordinary graders.

That is why modern Adams 80 to 150 hp machines give you 8 standard speeds forward and 4 reverse, plus 3 creeper speeds (optional), for a total of 15 speeds . . . all operating through full constant-mesh transmission. Range of the 123 hp Adams 550, shown in chart below, is typical.

Wider range of forward speeds match power to load

For smoothing and building haul-roads, ditching, clean-up at pit, plant, and stockpile, Adams provides 4 efficient working speeds. Other graders, with 6 forward speeds, have only 3 working speeds. Here's an example of what this means in operation: Adams moves a given load in 3rd gear at 4.6 mph, using full horsepower. With a 6-speed grader and the same load, your operator would have to drop back to 2nd gear, 3½-4 mph . . . or go to 3rd gear where he would have to cut-back the throttle, thereby losing power. It's like that on every operation . . . Adams' 15 speeds get more work done *faster* every day, the year 'round.

Adams' two intermediate speeds, 10 and 14 mph, come in handy for light, fast blading, maneuvering, and climbing tough grades. Travel speeds to 25 mph move rig quickly from job-to-job. Adams foot accelerator and dual-action hydraulic brakes make travel on winding roads, slopes, benches, near other machines, safe, easy, and comfortable as driving a modern truck.

Reverse speeds to 13 mph save time on shuttle grading

Most graders have only 2 reverse gears, with speeds to about 3 and 7 mph. Adams has 4 reverse gears . . . 2 for working, 2 for high-speed back-up. Again, this wider range of speeds gets more work done, uses engine power to full advantage.

But it's Adams' 3rd and 4th reverse speeds that pay the big dividends! Many times your operator works a 200′ to 400′ stretch or even more. It's too short, or the area too confined, to make turn-around practical . . . so he backs-up. Adams' higher reverse speeds of 8 and 13 mph get the grader back to its starting point fast, convert wasted travel time to extra blade-work. These gears also cut maneuvering time, speed back-up to buck snow drifts.

Creeper gears extend grader's working range

Three optional creeper speeds are available, as original equipment, or as an extra which can be added in the field. These gears are in the low-low range of operating speeds, 0.25 to 1.76 mph. They afford a means to concentrate full engine power for ripping up old roadways, pulling stumps, and working through rocks and roots. Creepers eliminate the necessity for "slipping the clutch" at high RPM to get steady power at slow speed . . . reduce shock and clutch wear. Creepers also make it possible to cut more accurate grades, and work in tight places.

190 hp POWER-*Flow* "660"

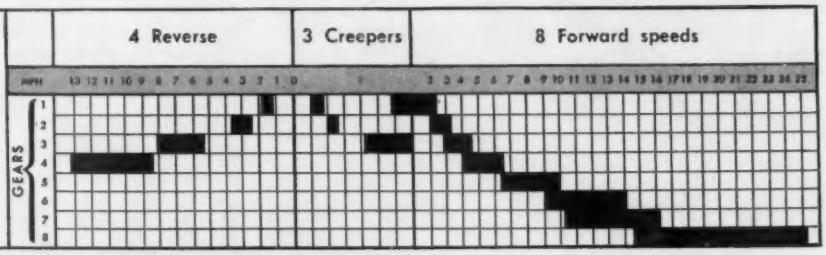
For extra push-power at *all* speeds, Adams POWER-*Flow* 660 with torque converter gives you 27% more engine power, plus the effective work-power of an infinite number of gear ratios, 0.0 to 27.4 mph.

For grader operation at most efficient speeds, specify 15-speed standard transmission or torque-converter drive. Contact us for details on Adams 190, 150, 123, 104, 80, 60 hp graders.

Adams, POWER-Flow—Trademark AG-48-M-b

Work speed range
Adams "550"

Speed range is shown between RPM at which maximum torque is obtained, and RPM at which maximum engine horsepower is developed.



LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

DOW

XANTHATES: collectors of consistent quality, in pellet form for dustfree handling. Wide range assures high selectivity.

LET THESE Recovery Chemicals

WHEN a mill's sulfide flotation costs are at rock bottom, chances are you'll find Dow Xanthates and Dowfroth® 250 at work in the recovery process. Carefully compounded for independent collecting and frothing, this pair functions in perfect balance to bring you the highest flotation efficiency known.

High selectivity

Dow offers a wide range of Xanthates that are substantially nonfrothing, completely and quickly soluble in water. They are designed for selective flotation to assure maximum loading of the froth as ore conditions change. In addition, these superior collectors assure an unusual ease in handling, for the entire series comes in pellet form. No dust, waste, or spillage problems!

Livelier froth

The ideal working partner to Dow Xanthates—or any other *collector*—is Dowfroth 250. It is completely water-soluble also, and produces a froth that's lively over a wide range of conditions. In many cases, Dowfroth 250 reduces frother consumption as much as 75%! Action is rapid and non-collecting, better accommodates ore variation. And froth is easy to launder, pump and thicken; does not deteriorate rubber parts.

Everyone benefits

Flotation experts agree that Dow Xanthates and Dowfroth 250 do much to improve recovery and concentrate grade. The metallurgist has better control of frother and collector. And the operator's work is pleasanter, thanks to the pellet form of Xanthates and the low volatility of Dowfroth 250. Why not write us for samples today and let every member of your flotation team discover the advantages of these dependable mining chemicals!

DOWFROTH 250 (shown in sample jar): a livelier frother that's noncollecting, easy to regulate. Often cuts consumption 75%!

PROVE THEIR EFFICIENCY TO YOUR WHOLE TEAM

Of course, technical assistance is always available, and oftentimes serves as a short cut in solving problems . . . in finding the answer to increased production per flotation dollar.

We would also be pleased to send a sample of Separan 2610®, the new high-speed flocculant that is doubling—even tripling—production in settling and filtration operations. As little as one pound settles 100 tons of solids! THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. OC 858N-1.

SEPARAN 2610—Amazing speed of new flocculant is setting economy records throughout the mining industry. One uranium processor, for instance, reports savings of nearly $3000 a day! Faster settling and increased filtration have eliminated four of his five thickeners, two banks of filters, and several earthen ponds.

YOU CAN DEPEND ON DOW

Horizontal drilling with Air Feed Leg mounted sinker.

Less time to set up and tear down with Gardner-Denver air feed leg

Recommended to replace jumbos in smaller headings and inaccessible workings. No time wasted in setting up columns or crossbars. One man brings Air Feed Leg mounted drill into position and starts drilling.

- Adjustable feed leg pressure provides proper feeding in horizontal or up-hole drilling
- Controls conveniently located on backhead
- Push-button air release in feed leg
- Automatic water gland for water-on, air-on, air-off, water-off cycle
- Constant chuck-end blowing stops cuttings from entering drill
- Piston rod wiper excludes dirt
- Supports drill in rigid stoper bracket for up-hole drilling
- Drill easily removed for use as sinker

Model FL58
Air Feed Leg.

WRITE FOR BULLETIN

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
Gardner-Denver Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Now for the first time, a tungsten carbide insert bit, "drilled to destruction without the need of resharpening." Lower first cost, lower cost per foot drilled.

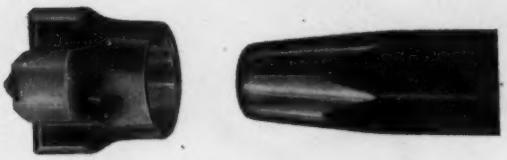
FORGED FROM SPECIAL ALLOY STEEL FOR STRENGTH AND TOUGHNESS

LIDDICOAT
TEE CEE BIT

Liddicoat was the pioneer in the development and manufacture of the single-use steel bit. Now, after years of experience and research, there has been developed a tungsten carbide-insert Liddicoat bit that completely revolutionizes drilling with carbide bits.

The new line of Liddicoat TEE CEE bits (patents applied for) are "drilled to destruction without the necessity of resharpening." The design of the bit and inserts is such that even when dulled a reverse taper does not occur. In the conventional multi-use carbide bit, a reverse taper stops drilling. The four-point bit permits fast collaring, fast cutting, and easy removal from the hole. In spite of these many desirable features, this bit is offered at a new low first cost, which provides low cost per foot of hole drilled.

TAPER SOCKET... NO THREADS FAST, FIRM ATTACHMENT



Illustrated is the improved taper perfected to provide ease of attachment and removal. No threads to strip; longer rod life.

Because of spectacular performance, the Liddicoat single pass taper socket TEE Cee bit is already in use by many of the world's important mining and construction companies.

For information contact your Liddicoat Dealer or Western Rock Bit Manufacturing Company.

WESTERN
Rock Bit Manufacturing Company

552 West 7th South • Salt Lake City 4, Utah

DORRCO *JET* SIZER

at Climax Uranium...

Closeup of Dorrco Jet Sizer at Climax Uranium taken from overflow end of machine.

This 65' dia. Dorr Thickener thickens slimes and returns overflow for re-use.

Earliest producer on the Colorado Plateau, Climax Uranium uses Dorr-Oliver equipment for key classification, thickening and filtration steps throughout the flowsheet. The initial sand-slime separation is made in a 7½ pocket Dorrco Jet Sizer. Feed to the unit is 400 TPD of all 28 mesh material which is split at 150 mesh. A hindered settling classifier, the Dorrco Jet Sizer utilizes an overhead, removable hydraulic water distribution system which eliminates costly constriction plate construction. Adjustments to changes in feed composition are automatic to insure constant pulp density and product quality.

Sizer spigot product goes to leach tanks and sizer overflow (−150 mesh) to a 65′ dia. Dorr Thickener. Thickener overflow is returned for re-use and underflow is sent to process. A 50′ dia. and 24′ dia. Dorr Thickener are also installed at Climax along with a number of Dorrco VM Pumps.

In the leaching section an 11′6″ x 12′ Oliver Panel Filter performs a liquid-solids separation on the leached uranium ore. Employing a floating cake discharger, the Panel Filter is ideal for handling slow filtering products forming slimy cakes.

For more information on the complete line of D-O equipment for the mining industry, write for a copy of bulletin No. 2200. Dorr-Oliver Incorporated, Stamford, Connecticut

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH · ENGINEERING · EQUIPMENT
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ALLIS-CHALMERS ADVANCED DESIGN

turns waste time into work time

You get *extra* money-making *work time* with an Allis-Chalmers crawler tractor on every job—dozing, winching, towing, pushing. Built for today's jobs, these crawlers are wheeling out more work in less time than comparable size machines.

Look at the facts

1,000-hour lubrication intervals save lube time

Allis-Chalmers tractors start the day with *go*—not greasing. You can operate six months on a 40-hour week basis with just one lubrication of truck wheels, front idlers and support rollers. Designed with Positive Seals and tapered roller bearings, these units are protected from dust, loose sand, soft ground, mud or water. You not only gain *working time*, but save labor and lubricant costs as well.

Modern shift pattern speeds digging

Here's a big timesaver on dozing work. It takes just half the time and effort to change from low forward to fast reverse with the Allis-Chalmers HD-6, HD-11, or HD-16 transmission. One simple shift of the gear lever does the job. You gain production time — up to 25 percent on actual test — on jobs calling for a short forward-backward cycle.

Unit construction cuts servicing time

No need to remove transmission or engine, radiator, grille, when servicing or removing an Allis-Chalmers master clutch. This unit can be removed without disturbing adjacent parts. This is also true of other main assemblies — final drive gear, transmission, steering clutches, engine and truck frame. As a result, hours of *costly service and downtime are saved* because of Allis-Chalmers advanced design.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

Get the complete story from your Allis-Chalmers construction machinery dealer

ALLIS-CHALMERS

How Tractor Operators **Save 50% on Parts Replacement Costs**

Build-up and hardfacing with Amsco® Automatic Welding saves money, doubles service life

The operator shown here is depositing Amsco AW-79 . . . to build up cash savings for tractor operators.

By rebuilding and hardfacing with Amsco Automatic Welding, he is adding *double the service life* of the original part . . . at about *half the cost* of a replacement part.

The Amsco "550" Automatic Welder is specially designed for this heavy-duty service. And Amsco AW-79 Alloy Steel Electrodes provide high impact and abrasion resistance.

Both large contractors and repair shops can make the Amsco "550" pay for itself in short order. Ask your Amsco Distributor for full details on the "550" Automatic Welder and the full line of Amsco Hardfacing Electrodes.

Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division · Chicago Heights, Ill.

OTHER PLANTS IN: DENVER, LOS ANGELES, NEW CASTLE, DELAWARE, OAKLAND, ST. LOUIS; JOLIETTE, QUEBEC

The Production Division of the Carpco Group

Carpco

MANUFACTURING, INC.

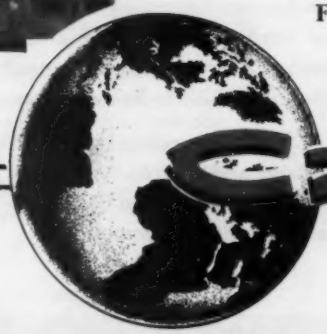
Carpco manufactures over sixty models of separation and accessory equipment all designed to offer complete interchangeability of parts for integrated plant design.

Industrial and laboratory model high tension and magnetic separators in continuous production.

Quality control is assured by complete manufacture.

Carpco materials handling equipment provides plant integration.

From the smallest detail to completely packaged plants — it's Carpco *all over the world!*



Carpco

CARPCO RESEARCH AND ENGINEERING • CARPCO MANUFACTURING, INC.
CARPCO CONSTRUCTION CORPORATION • CARPCO EXPORT CORPORATION
JACKSONVILLE, FLORIDA, U. S. A.

New LORAIN-85A

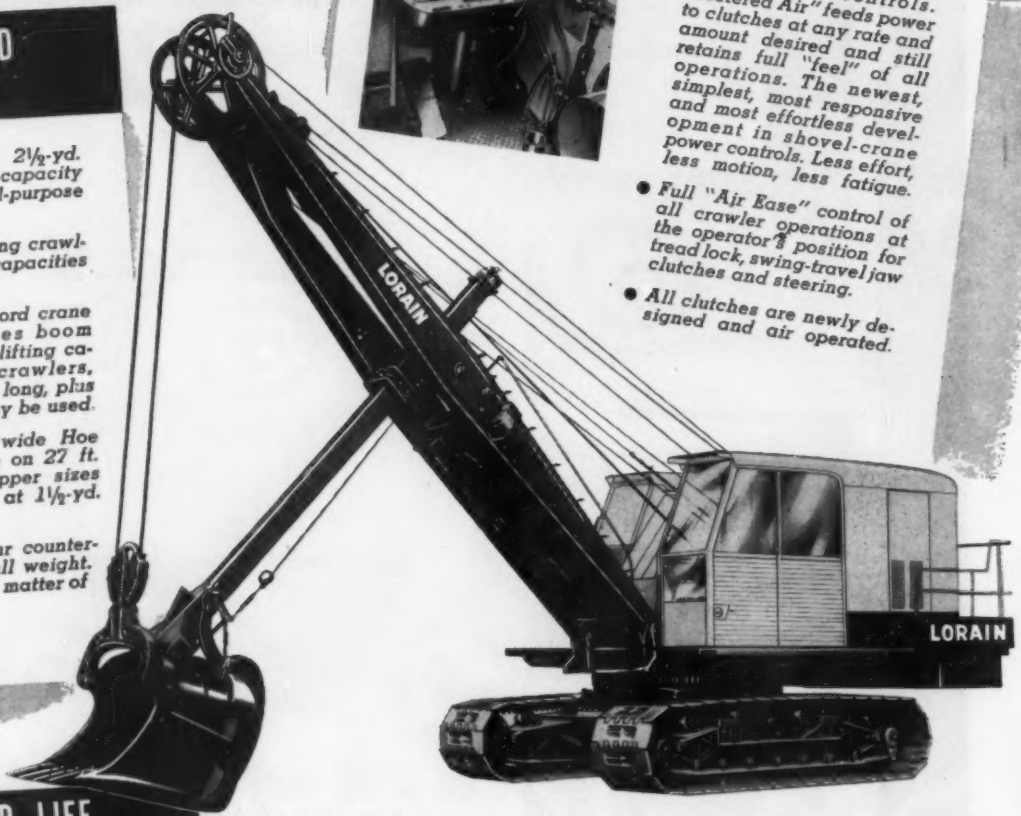
brings 2½-yd. shovel users new performance-profits!

"JOY STICK" AIR CONTROL for easier operation

- *Greater operating ease with 2-lever "Joy Stick-Air Ease" power controls. "Metered Air" feeds power to clutches at any rate and amount desired and still retains full "feel" of all operations. The newest, simplest, most responsive and most effortless development in shovel-crane power controls. Less effort, less motion, less fatigue.*
- *Full "Air Ease" control of all crawler operations at the operator's position for tread lock, swing-travel jaw clutches and steering.*
- *All clutches are newly designed and air operated.*

FOR INCREASED CAPACITIES

- *The Lorain-85A is a 2½-yd. shovel with 41 to 48-ton capacity as a crane on a general-purpose 2-speed crawler.*
- *An extra-wide, extra-long crawler provides for crane capacities of 50 to 60 tons.*
- *New square-tubular-chord crane boom design reduces boom weight and increases lifting capacities. On large crawlers, boom length to 200 ft. long, plus 40 ft. tip extension may be used.*
- *New 2½-yd., 62-in. wide Hoe bucket now available on 27 ft. boom. Other Hoe dipper sizes available beginning at 1½-yd. sizes.*
- *New, removable rear counterweight reduces overall weight. Can be removed in a matter of minutes.*



FOR LONGER LIFE LESS SERVICE COST

- *New Shear Ball mounting . . . the new idea in turntable mounting design. Turntable is secured to crawler and revolves easily and freely on a huge "ball bearing." No center pin or nut—no turntable rollers—with their adjustments, maintenance and lubrication.*
- *Torque converter power-take-off is available for the most efficient, smoothest method of taking full advantage of the abundant power supplied for turntable operations. "Never-say-die" power; adjusts automatically to digging needs; no shock; no stall.*
- *Generous use of anti-friction bearings throughout the new Lorain-85A. Used on hoist drums, swing drums and retract and crowd clutch drums. Crane boom head sheaves also on anti-friction bearings.*

Nothing has been spared in the new Lorain-85A to put it far ahead of the field in the 2½-yd. shovel-crane class. Every improvement, every refinement—from the new look in the new cab to the hidden anti-friction bearings—has been incorporated to give owners the last word in performance and profits. Many design improvements that increase capacity and result in easier, smoother operation enable the "85A" to live a longer, trouble-free life.

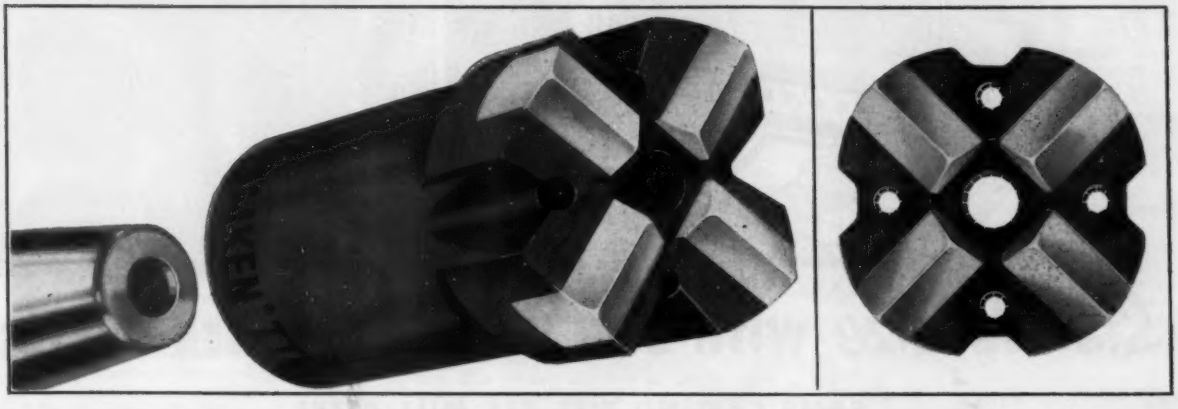
Don't miss seeing it. Ask your Thew-Lorain Distributor for all the facts and figures. Make every comparison. Only then can you appreciate the Lorain-85A built-in values that will pay you profits for a long time to come!

THE THEW SHOVEL CO., LORAIN, OHIO

THEW LORAIN®

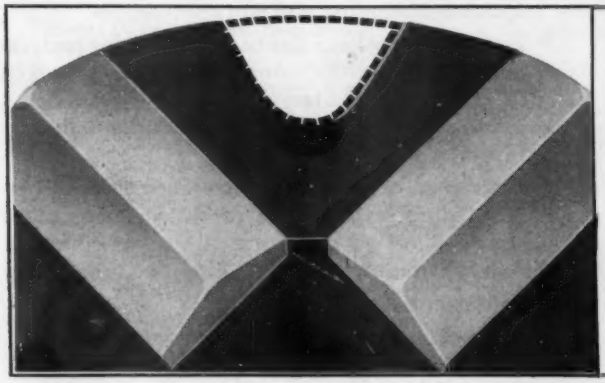
For air-leg drills and light stoping . . .

New Timken® Tapered Socket Bit speeds drilling 3 ways!



1. TAPERED SOCKET GIVES MORE SECURE UNION—The new Timken® bit has a tapered socket that provides a more secure union than threads for air-leg drills. Its precision-made taper fits tight to the drill steel yet permits quick and easy bit changes to speed drilling. Breakage is reduced, bit cost cut. New, special analysis carbide inserts give cutting face superior wear-resistance, with added shock-resistance. And a body of Timken electric furnace fine alloy steel helps Timken tapered bits give you lowest cost per foot-of-hole.

2. 5-FRONT-HOLE JET ACTION WASHES CHIPS BACK FASTER—New frontal design shoots five jets of water in front of the bit to wash away chips faster. Bit spends less time "drilling" chips, more time drilling new rock.



3. DEEPER, WIDER WING CLEARANCE SPEEDS CHIP REMOVAL—Extra deep, wider clearance between cutting wings permits water to carry chips away faster from the cutting face of the bit. This faster chip flow helps increase cutting efficiency, speeds drilling. New Timken bits come in three popular sizes: 1¼", 1⅜" and 1½". Write for free brochure. The Timken Roller bearing Company, Canton 6, Ohio. Cable: "TIMROSCO".

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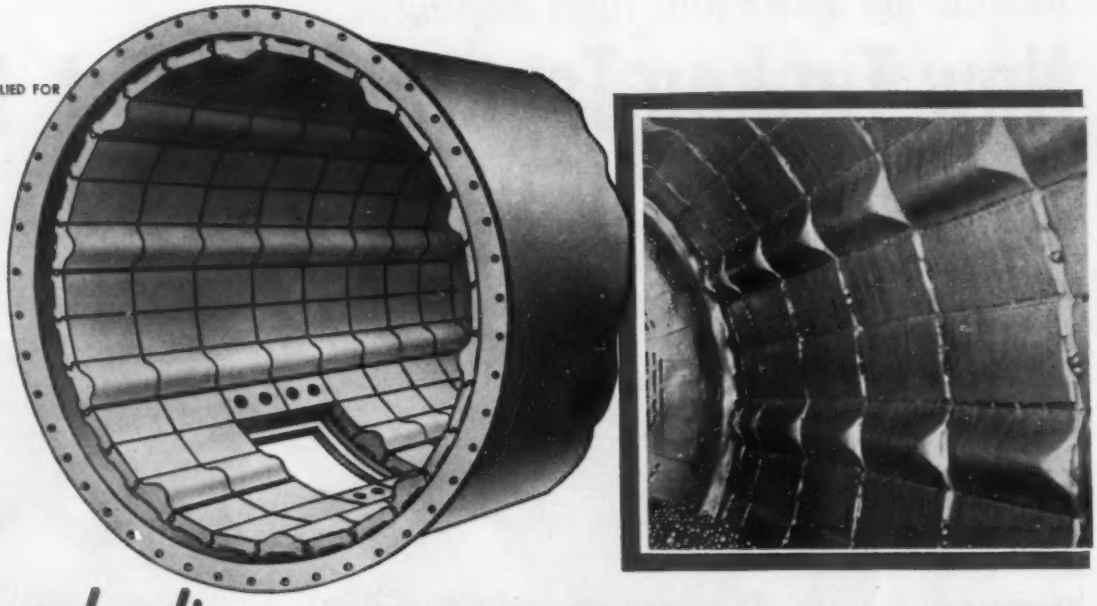

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Liners are supplied in two nominal thicknesses, 1½″ and 3″ with 1½″ high lifters. Castings are 6″ wide x 12″ long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates, write The Babcock & Wilcox Company, Process Equipment Department, Barberton, Ohio.

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S-464

United States

Personalities in the News——

W. A. "BUD" EMANUEL (left) has been named manager of the Anaconda Reduction Department of the Anaconda Company, in Montana. He succeeds WILLIAM E. MITCHELL (right) who retired January 1, after 45 years service. FRANK DAY, assistant general superintendent of pyrometallurgy, has been promoted to general superintendent of the Reduction Department. JOHN MOORE, assistant general superintendent of hydrometallurgy, has been named assistant general superintendent. JOHN BOLLES has been advanced to concentrator metallurgist. CARL J. LUNDBORG, assistant chief engineer at Butte, has been named to succeed ROLLIN J. KENNARD, chief engineer (mechanical and electrical) of the company's Western Operations.

Dr. Eugene Callaghan has been appointed chief geologist in charge of exploration for Haile Mines, Inc., with field headquarters in Salt Lake City. For the past 7½ years Mr. Callaghan has served as director of the New Mexico Bureau of Mines and Mineral Resources, and was formerly professor of economic geology at Indiana University and geologist in the former metals and nonmetals sections of the U. S. Geological Survey.

Emmett G. Solomon has been named a director, vice president, and treasurer of The Bunker Hill Company, replacing the recently deceased **Daniel J. Murphy.**

Troy B. Hunt is the new plant manager of Olin Revere Metals Corporation's reduction plant at Omal, Ohio. He had been in charge of designing the plant while at Olin Mathieson Chemical Corporation. **Carl R. Rowe** has been named plant manager of the rolling mill at Omal which is operated by the Olin Mathieson's aluminum division.

John G. Strohl has been appointed general manager of the Camp Bird mine at Ouray, Colorado. **C. P. Tremlett,** chief geologist, has been acting manager since October.

Frank Eichelberger, Jr. will be general manager of the new $250,000 zinc refining plant of Northwest Refining and Chemical Company in Spokane, Washington. He was formerly associated with his father, who died recently, in an engineering consulting firm in Spokane.

Charles Hubbard has moved from the Idaho Bureau of Mines and Geology at Moscow, to the Spokane field office of the U. S. Bureau of Mines. He is a graduate of the Missouri School of Mines.

Dr. Truman H. Kuhn has been named dean of the faculty of the Colorado School of Mines, succeeding **M. I. Signer** who died in November. Dr. Kuhn has been dean of the graduate school since 1953, and came to the school in 1942 as a member of the geology department.

J. R. LeGrand has been appointed production manager of the Consolidated Feldspar department of the Industrial Minerals Division, International Minerals and Chemical Corporation. He has been superintendent of the company's mica plant at Erwin, Tennessee for the past year. **Richard N. Hill,** an engineer for the Research Division of the company at Lakeland, Florida, has been promoted to development manager Perlite department, of the Industrial Minerals Division at Los Angeles.

J. H. Davis, Jr. has been chosen as chief mechanical engineer, western engineering department, of the Phelps Dodge Corporation in Douglas, Arizona. He had been assistant mechanical engineer for several years, and in his new position succeeds **H. V. Kruse** who retired over a year ago.

Andy Kangas has retired after 53 years of service to the mining industry. His career started at 13 in 1904 when he operated a shaft sinking hoist and trolley motor in a Michigan copper mine. He has been with Potash Company of America, Carlsbad, New Mexico, since 1933. After several promotions, he became shaft foreman in 1949.

W. Y. Querry has been advanced from assistant superintendent to the post of superintendent of Tennessee Copper Company's smelting department. **W. A. Hardin, Jr.,** former technical assistant in the smelting department, is the new assistant superintendent.

John A. Featherstone has been named to succeed his father, the late **Judge A. H. Featherstone,** as president and general manager of Golconda Lead Mines, Wallace, Idaho. **H. F. Magnuson** has been appointed to fill John Featherstone's previous position of vice president.

George J. Allen was recently appointed sponge iron shift foreman of Kennecott Copper Corporation's Ray Mines Division in Arizona; **Larry McCreary** was named sponge iron shift foreman of the LPF plant; and **Norton Newcomb,** former supervisor of Labor Relations, was appointed director of communications. At the Nevada Mines Division of the Company, in McGill, **Howard H. Robison** was chosen to be safety engineer and **John G. Smith** was named director of communications. The Utah Copper Division promoted **Alvin J. Thuli, Jr.** to chief engineer. At the Chino Mines Division in Hurley, New Mexico, **Harlan G. Bower** was named director of communications.

W. F. Shinners has been chosen manager of the Michigan District mines of the M. A. Hanna Company, replacing **S. E. Quayle,** who is retiring after 39 years with the company. **Kurt R. Kuehlthau** is the new general superintendent of underground mines and **J. D. McAuliffe** is now superintendent of the Homer-Wauseca mines. **Jack H. Morrow,** former chief mining engineer, is now operating engineer of the Homer-Wauseca mines. **Richard W. Peterson** has been named chief mining engineer of the Michigan District.

Willis W. Osborne, treasurer, and **Fremont F. Clarke,** general manager of operations, both vice presidents of Lithium Corporation of America, Inc., have been elevated to newly created posts as senior vice presidents. Four new vice presidents were also named: **Dr. R. B. Ellestad,** director of research; **Walter M. Fenton,** director of products research and development; **J. Dean Herman,** director of chemical plant operations; and **J. D. Campbell,** director of sales.

Jackson How will serve American Smelting and Refining Company as director of public relations. Mr. How is vice president of John Mather Lupton Company, Inc., advertising and public relations agency.

Claude O. Dale was recently appointed assistant general manager of the Mining and Smelting Division of The Eagle-Picher Company, with headquarters at Miami, Oklahoma. **Robert L. Haffner** has been named manager of the company's Illinois-Wisconsin operations to succeed Mr. Dale. **Harold H. Haman** will replace

DR. AUGUSTUS B. KINZEL (left), vice president in charge of research at Union Carbide and Carbon Corporation, has been elected president of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. for a one-year term beginning February 1958. GROVER HOLT (center), general manager of the ore mining department of The Cleveland-Cliffs Iron Company, took office as 1957 AIME president at the annual meeting in New Orleans during February. LAMAR WEAVER (right), general superintendent of Tennessee Copper Company, was chosen for a three-year term as a director. Other 1958 officers include vice presidents EDMUND C. BABSON, Calgary, Alberta, and ROGER V. PIERCE, Salt Lake City consulting mining engineer. New directors are LUTHER C. CAMPBELL, Pittsburgh; FRED W. STRANDBERG, chief mining engineer at Butte Montana for the Anaconda Company; ARTHUR W. THORNTON, Pittsburgh, assistant to the vice president in charge of operations, National Tube Division, U. S. Steel Corporation; THOMAS C. FRICK, Dallas; JAMES S. VANICK, New York research metallurgist, International Nickel Company.

FRANK P. KNIGHT, mining engineer of Tucson, Arizona, has been named acting director of the Arizona Department of Mineral Resources. He succeeds ROGER I. C. MANNING, department director since 1951, who died last December. Mr. Knight has been president of the Christmas Copper Corporation since 1953. Recently he has been directing mining operations at the Bonanza mine in Santa Cruz County for the Sam Knight Mining Lease, Inc., and maintaining his office in Tucson.

Mr. Haffner as general superintendent of the same operations. **Henry B. Farrey**, former chief engineer, succeeds Mr. Haman as superintendent of the Linden, Wisconsin mine. In the Tri-State District of Oklahoma, Missouri, and Kansas, **F. J. Cuddeback** has been appointed general manager to succeed **H. W. Harrison** who is retiring. **J. B. Elizondo** will replace Mr. Cuddeback as general superintendent of Tri-State Mines and **Lloyd Wetherell** has been promoted to assistant general superintendent.

Alvin J. Thompson will serve the New Mexico Bureau of Mines and Mineral Resources as director, succeeding **Dr. Eugene Callaghan**, resigned. Mr. Thompson was formerly head of the mining department.

Lee Messerly resigned as superintendent of Hecla Mining Company's Star zinc-lead mine near Wallace, Idaho, to become director of mining operations for Federal Uranium Corporation of Salt Lake City. Mr. Messerly had been with Hecla since 1923.

Dr. Robert Franklin Mehl has been awarded the Pittsburgh Award for 1956, presented by the Pittsburgh section of the American Chemical Society. Dr. Mehl is head of the department of metallurgical engineering of the Carnegie Institute of Technology, as well as being director of the metals research laboratory, and Dean of Graduate Studies.

J. William Bryant has taken over the duties of **C. L. Kingsbury**, who has retired as vice president of Reserve Mining Company, which is jointly owned by Armco Steel Corporation and Republic Steel Corporation. Mr. Kingsbury will still serve in a consulting capacity to Armco. Mr. Bryant will continue to be treasurer and controller of Reserve, but will move his offices from Cleveland, Ohio to Silver Bay, Minnesota.

Herbert A. Wendel has been appointed chairman of the bureau of safety of The Anaconda Company and subsidiary companies. He succeeds **John L. Boardman**, who has retired after 33 years with Anaconda. For more than 25 years Mr. Wendel has been closely associated with safety work in the company's Butte mines.

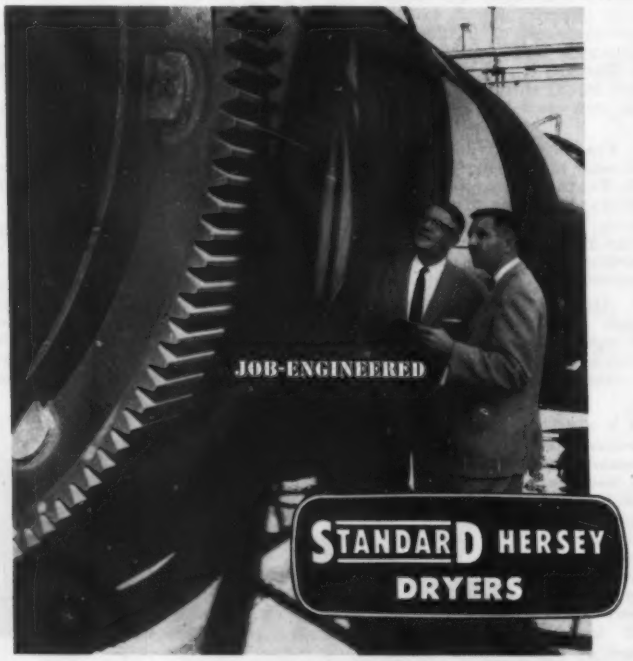
Dr. B. D. Thomas is the new director of Battelle Memorial Institute and in this position succeeds **Dr. Clyde Williams** in the management of Battelle's extensive research operations in the United States and Europe. Dr. Williams is now president of the Institute.

Obituaries

Henry W. Kaanta, 67, nationally known metallurgist, died recently in El Paso, Texas. The American Smelting & Refining Company mill at Deming, New Mexico was built under Mr. Kaanta's supervision and he had been superintendent there until his retirement a year ago. He had been associated with the company for 24 years, and before that he was affiliated for several years with Phelps-Dodge Corporation.

Donald A. Stewart, dredgemaster for National Silver-Lead Mining Company at Wallace, Idaho, and also Northern Mining Company, died in a recent Alaskan air line crash. Mr. Stewart was once employed by Sunset Minerals, Inc., near Kellogg, Idaho.

Frank Eichelberger, 71, internationally known mining engineer and mining company executive, died recently at his Hayden Lake home near Spokane, Washington. He was general manager of American Chrome Company and Conjecture Mines, Inc. at the time of his death. Mr. Eichelberger had been active in the mining industry since his graduation in 1909 from Michigan College of Mines, and has been credited with making possible the construction of 16 metallurgical plants in the United States. In 1952 he went to South Korea as a mining advisor to President Syngman Rhee. He had held many positions of importance with mining firms throughout the country, including presidency of Tacoma Powdered Metals Company, San Juan Metals Corporation, Standard Metals, Inc., and Kalunite, Inc.



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Newsmakers in International Mining

Lindsay Thomson was recently appointed mine superintendent of Mount Isa Mines, Ltd., Australia, to replace the late **John Thorburn.** Mr. Thomson joined the company in 1951 as research engineer in the mining department. Soon after he received the Queensland government's Silver Medal for bravery when he climbed down a disused rise into a dangerous open stope leading a rescue team to the victim of a mine accident. He was promoted to mine foreman in October 1952, later to production engineer, and then to assistant mine superintendent. In July 1955 he made a three-month tour of the United States and Canada.

Charles Sweetwood, who recently returned from foreign assignments for the J. R. Simplot Company, was named assistant manager of the exploration and development department.

Wally Walters, former assistant underground manager of the South Orebody shaft of Rhokana Corporation, Ltd., at Nkana, Northern Rhodesia, has been transferred to the Konkola Shaft as manager, and **John Northrop,** former acting plant metallurgist at the concentrator, has gone to Kansanshi as mill supervisor.

Robert M. Haldeman, general manager of Braden Copper Company, a subsidiary of Kennecott Copper Corporation has been appointed vice president. He is chief executive of the company in Chile, with offices in Santiago.

Carl Olof Gudmund Borelius, professor of physics at the Royal Institute of Technology in Stockholm, Sweden, recently addressed a meeting of the Physical Metallurgy Group of the New York section, American Institute of Mining, Metallurgical, and Petroleum Engineers. This subject was "The Early Stages of Precipitation—Alloys." During his visit to the United States, Dr. Borelius also lectured on metallurgy at the University of Illinois.

Arsen P. Pensa is the new manager of Radusa, Chromite Mines, at Skopje, Yugoslavia. He had formerly been with Trepca Lead and Zinc Mines for eight years, the last four as mine superintendent.

Avelino F. Suarez has resigned his position as mill foreman for Benguet Consolidated Mining Company, Masinloc, The Philippines, to become mill superintendent of Masara Mining Company, Davao City, Philippines.

I. K. Hearn, Jr., industrial engineer for the Western Mining Division of the Kennecott Copper Corporation, and **J. C. Landenberger, Jr.,** superintendent of operations at Kennecott's Utah Copper Division, have been temporarily loaned to the Kennecott subsidiary in Chile, Braden Copper Company, to make special studies.

Charles W. Sturgeon has been named underground manager for Central and South Orebody shafts of the Rhokana Corporation, Ltd., at Nkana, Northern Rhodesia. Mr. Sturgeon had been assistant to the former underground manager, **Gordon Rethman,** since March 1955. Mr. Rethman resigned to take up new duties at Nchanga. New assistant underground managers have been appointed at all three Nkana shafts: **Stanley F. Gander** at Central; **Mike Stephenson** at South Orebody; and **Karel Opperman** at Mindola. **Tony Darval** has been appointed engineer superintendent of the company and his former position as divisional engineer (maintenance) has been filled by **Frederick C. Perkins,** power plant superintendent.

Bruce E. Kennedy will be engineer in charge of Pickands Mather & Co.'s eastern Canadian explorations. He was formerly with the Duluth office of the company.

Wing L. Lew, general superintendent of the St. Joseph Lead Company's Aguilar property in the northern province of Jujuy, Argentina, recently visited the company's Hayden Creek mine, in Missouri, and other Lead Belt operations.

I. M. McLennan, general manager of the Broken Hill Proprietary Company, Ltd., Australia, is president of the Australasian Institute of Mining and Metallurgy for 1957.

Art Glover plans to leave Alaska where he has served for 17 years with the Territorial Department of Mines. Mr. Glover joined the Department in 1940 as assayer at the College station and in 1950 was transferred to Ketchikan. He was largely responsible for direction of the successful exploration conducted by prospectors throughout southeastern Alaska in recent years.

R. G. K. Morrison, professor of mining engineering at McGill University, Montreal, Canada, recently conducted a study of underground rock conditions in the Wallace, Idaho area for American Smelting and Refining Company.

W. Smit, former underground mining engineer for Cerro de Pasco Corporation in Peru, is now with the Anaconda Company in Butte, Montana.

R. M. PORTER is the new superintendent of the Sullivan mine of the Consolidated Mining and Smelting Company of Canada Limited, at Kimberley, British Columbia. He has been operating superintendent there since June 1955, and originally joined Cominco in 1937 as an engineer at Aiken Lake. J. E. McMYNN has been named assistant to the general superintendent, Kimberley Operations, which include the Sullivan mine and concentrator and the Kimberley Fertilizer department. J. R. MILLS will leave his post as chairman of the company's research board, which he has held since 1951, to become assistant manager of the Research and Development Division.

J. ROY GORDON has been elected executive vice president of The International Nickel Company of Canada, Limited, and also executive vice president of the firm's United States subsidiary, The International Nickel Company, Inc. He has been a vice president of the parent company since June 1953 and of the subsidiary since January 1955. Mr. Gordon joined Inco in 1936 as director of the research department established that year at Copper Cliff, Ontario. RALPH D. PARKER was elected a director of Inco to succeed JAMES S. DUNCAN who resigned recently to become chairman of the Hydro-Electric Power Commission of Ontario.

Dr. Charles Fairhurst, from Sheffield University in England, has joined the staff of the Department of Mineral Engineering at the School of Mines and Metallurgy, University of Minnesota. His principal research interest is rock drilling and he has written several papers on the subject.

Mark Lintz, mining and metallurgical engineer of San Francisco, has just returned from mine examination work in the State of Jalisco, Mexico. His present field address is Box 672, Prescott, Arizona.

D. H. Harraway has joined the staff of the metallurgical department of the University of Minnesota. He was formerly with Mount Isa Mines, Ltd., Queensland, Australia.

J. de Lavallee Poussin has resigned as managing director of Uruwira Minerals Ltd. in Tanganyika and established himself as a consulting geologist in Nairobi, Kenya. Uruwira Minerals is one of his clients.

F. G. Sharp has taken on the duties of superintendent of the Kolar Gold Mining Undertakings (Mysore mine), South India. He was formerly connected with the Hyderabad Gold Mines Company Ltd.

A Russian delegation of 13 mining engineers and metallurgists visited Sweden in September to study Swedish ore prospecting and metallurgy. In exchange, a Swedish delegation will visit the Soviet Union.

R. Yoshioka recently completed a tour of Australian mining and metallurgical areas, particularly the copper and lead mines and ilmenitic beaches in Western Australia.

Frederick W. Matthews has been appointed mining recorder for Eastern Ontario, Canada, with offices in Toronto.

Professor Otto Barth, metallurgist, has taken up residence in Sao Paulo, Brazil. He was formerly associated with Kungl, Tekniska Hogskolan in Stockholm, Sweden.

W. C. Fairbairn has been transferred from the Mines Department at Kampala, Uganda, to Sierra Leone.

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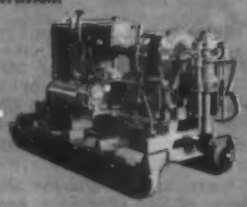

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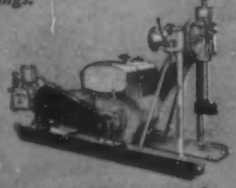

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Silver Bowl, Inc. has entered into a perpetual working contract with the *Bunker Hill Company* for deep development of the old *Senator Stewart* mine in Deadwood Gulch at Kellogg, Shoshone County, Idaho. A 1,500-foot extension of Bunker Hill workings would reach the Silver Bowl area. Profits would be divided 50-50 in one area and 75-25 in favor of Bunker Hill in another. The operating firm would pay off $159,339 of Silver Bowl indebtedness, taking as security to guarantee repayment 70,000 shares of *Federal Uranium Corporation* and 35,000 shares of *Radorock Resources, Inc.* Located in 1895, the Stewart reportedly yielded about $15,000,000 worth of lead-silver ore to Augustus Heinze, one of Montana's Butte "copper kings," from 1911 to 1914.

Nabob Silver-Lead Company, at last report, was preparing to start milling lead-zinc ore extracted in developing its new winze level in the Pine Creek district of the Coeur d'Alene mining region, Shoshone County, Idaho. The work was expected to provide 80 to 100 tons of mill feed daily. Values and width in two drift faces at the new 180-foot depth compared favorably with the 14 percent combined metal and 7½-foot width noted in sinking operations. Stanley W. McDougall, manager of mines for the *Bunker Hill Company*, has been appointed to the Nabob board of directors and will serve in an advisory capacity. C. C. Dunkle, of Kellogg, is vice president and manager.

Expenditure of $15,000,000 over the next five years is planned by the *Bunker Hill Company* at its Kellogg, Idaho operations to strengthen its position in the metals industry. The program will provide for expansion and modernization of plant facilities and equipment and for enlargement of facilities for recovering such byproducts as silver, copper, antimony, and cadmium. The 70-year-old firm has been engaged primarily in the mining, smelting, and refining of lead and zinc. The company currently is well along in a $7,000,000 expansion of its electrolytic zinc plant. John D. Bradley of San Francisco, California is president.

Idaho Goldfields, Inc. has made an initial truck shipment of concentrates from its property near the summit of Fourth of July Canyon east of Coeur d'Alene, Idaho, near the Kootenai-Shoshone County border. Values were in lead, silver, and gold. Ore is being extracted from a shallow inclined shaft under a profit-sharing agreement with Coeur d'Alene district miners. L. A. Thompson, Spokane, is president.

Sunshine Mining Company has developed good grade ore in the *Robart* and *Omega* areas of the Chester vein in the Silver Belt of the Coeur d'Alene mining district, Shoshone County, Idaho. First found on the 37000 level of the Robart in a hanging wall structure of the vein, the ore since has been opened on the 3550 level and followed into the adjoining Omega area. At last report, the structure was being sought on the 3850 level.

The 73-year-old Frisco zinc-lead mine near Gem, Idaho, the Coeur d'Alene mining region's second oldest mining operation—was permanently closed at the end of 1956. Constantly rising costs without compensating increases in metal prices was given as the reason although the principal ore body had been getting smaller as mining operations progressed down to the 2,560-foot level. Located as the Helana-Frisco in 1884, the mine yielded 1,000,000 tons of ore up to 1906 when first shut down. It was operated in World War I by Federal Mining and Smelting Company, which was merged with the parent American Smelting and Refining Company several years ago. Except for intermittent leasing operations, the mine was idle from 1916 until 1942. Federal and ASARCO operations produced 827,000 tons of ore.

Harry G. and H. M. Kleinschmidt of Cuprum, Idaho and Carl H. Swanstrom of Council, Idaho have organized *Western State Mines, Inc.*, of Council with $50,000 capitalization.

Installation of a 100-ton mill is planned by *Idaho Alta Metals Corporation* at the old *Empire Copper* mine near Mackay, Alder Creek district, Custer County, Idaho. Production has been about three carloads of 4 percent copper ore weekly. Fourteen men were employed at last report. Roland Hunter is superintendent.

Imoco Ore Corporation has filed articles of incorporation at Boise, Idaho with capital of $10,000. Incorporators were Kenneth Steck, Weiser, and Earl L. Jones, Chicago, and former Illinois Governor Dwight H. Greene, also of Chicago. Exploratory operations were scheduled at Iron Mountain north of Weiser.

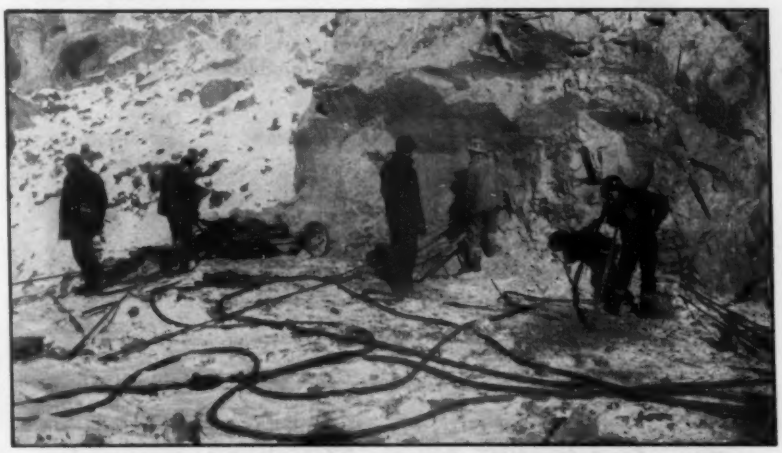
Sunshine Mining Company, Coeur d'Alene district silver producer, and *Highland-Surprise Consolidated Mining Company* of Wallace and Spokane, have abandoned their *Deer Trail* zinc-lead exploration project in Custer County, Idaho's Stanley Basin. Officials said an insufficient tonnage of ore was found to justify construction of milling facilities of a size necessary to make the project pay.

Western Fluorite Mining Company, Inc. of Warren, Arkansas is planning a rare-earths dredging operation next spring at the *Lucky Strike* properties on the Big Wood River south of Bellevue, Idaho and in the Boulder Flat area east of Easley, Blaine County. Installation of a sand plant at Bellevue or Hailey for separation of the rare metals also is planned. Long-range plans include a $1,000,000 chemical processing plant. Exploratory drilling during the 1956 season disclosed columbium, zirconium, titanium, thorium, uranium, and other minerals. H. S. Childs of Missoula, Montana is company representative at the project.

MONTANA

George O'Brien, Lewistown prospector, is planning smelter shipments of high-grade lead-gold-silver ore uncovered in bulldozing at the *Iron Chancellor* mine, Fergus County, Montana which he leased in May 1956. The vein was 18 inches wide where uncovered. The property is owned by *Rob Roy Mining Company* of Spokane, Washington. Ward J. Walker is secretary-manager of the firm, which also owns a 13-claim prospect in the Beaver mining district north of Wallace, Idaho.

The *Basin-Jib Gold Mining Company* has closed its *Jib* mine in Basin, Montana for the present time. This shaft, approximately 300 feet deep, was sunk 1½ years ago. The shaft was mucked with the Canadian-developed Cryderman shaft mucker representing the first use of this machine in the United States.



Woodgreen Copper Mines Opens 1,000-Ton Mill

Woodgreen Copper Mines, Ltd. has opened its 1,000-ton copper mill for treatment of ore from its open-cut mine just across the Washington-British Columbia border. Mining operations can be seen in the picture above. The work at the open-cut mine is done under contract by McClay Construction Company of Vancouver, B.C. Plans are already underway to expand the mill to 2,000-ton-per-day capacity. The crusher section has been built to feed a mill of 3,000 tons daily capacity. The concentrate will be shipped by rail to the Tacoma, Washington smelter of American Smelting and Refining Company. Some 2,000,000 tons of ore reportedly has been proven, with a potential of 5,000,000 tons to be confirmed by diamond drilling. Ore is said to average 1 percent or better. An erractic distribution of magnetite is also reported, but plans for treatment of this product have not been fully developed.

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NORTHWEST

The *Montana Land Board* has assigned an iron ore mining lease in Teton County, Montana to a Duluth, Minnesota firm. The area is about 18 miles west of Choteau. The lease was previously issued to Norman Whitaker who requested that it be assigned to the *Winston Brothers Corporation* and R. M. Adams, also of Duluth.

Gold Reserve Mining Company has been incorporated at Helena, Montana by Delbrook Lichtenberg of Ennis; William Foran of Seattle; Oliver Ebert of White Sulphur Springs; Don B. Bennett of Bozeman; and H. B. Landoe of Bozeman. The firm reportedly plans to mine and explore for gold.

Lincoln Mining Company has been deeded a 50 percent interest in a 21-claim uranium prospect in the Pryor Mountains of Montana in return for doing initial exploratory drilling. Management hopes to interest a larger firm in exploration of the ground more fully. C. J. Hamilton of Coeur d'Alene, Idaho, is president.

The *Marietta* mine 16 miles northwest of Townsend, Broadwater County, Montana has been purchased by *Forminco Inc.*, a Pennsylvania corporation. The property was owned by Albert Dance and Harry Anders.

R. C. McKelvie, Spokane mining man formerly of Calgary, British Columbia, has been preparing the old *Comstock* lead-silver mine west of Marshall Lake, Pend Oreille County, Washington, for production. Under a purchase option acquired a few months ago, he has installed an air compressor, bulldozer and other equipment, rehabilitated old tunnels, built ore bins, done some development work, and stockpiled more than 500 tons of ore for shipment to the *Bunker Hill Company* smelter at Kellogg, Idaho. Formerly operated by *Hoover Mining Company*, the property has been idle for some 15 years.

Exploration of copper-lead-zinc prospects in northern Stevens and Pend Oreille counties, Washington is planned by *Cambrian Mining Company* of Spokane, formerly a partnership under the name of *Cambrian Mining and Exploration*. First work will be geophysical and geochemical soil sampling by *Mine Consultants, Inc.* of Spokane. Otto L. Bagdon is Cambrian president and Kenneth R. Bagdon, secretary.

Republic Copper Company has sunk 20 feet on copper ore at its property on Goosmus Creek near Danville, Ferry County, Washington, and is considering an open-pit mining operation. An initial test shipment was recently to the Tacoma smelter of *American Smelting and Refining Company*. James Higgins heads the firm.

Exploration of 880 acres of state leases north of the Spokane Indian Reservation in Stevens County, Washington is planned by *Dawn Uranium and Oil Company* on the basis of uranium and copper showings found by J. J. Jutzy, consulting geologist. Previous work by the firm has been in northern Spokane County's Mount Spokane district. C. R. Echlin, Spokane, is secretary-treasurer.

A conference on geophysical methods and photogeology as applied to ore research, particularly in areas of rugged terrain such as that of the Pacific Northwest, will be held in Spokane, Washington March 14 and 15. Sponsors of the meeting are the *Northwest Mining Association*, the *Columbia Section AIME*, and the *Mining Bureau* of the *Spokane Chamber of Commerce*.

Howe Sound Company is continuing its copper exploration projects in Chelan County, Washington under contract extension with the Defense Minerals Exploration Administration. The government agency approved a $53,850 increase in the original $219,410 cost of the project from deep workings of Howe Sound's copper-zinc-gold mine at Holden. J. S. Roper is manager of the firm's Chelan Division.

A vertical diamond drill hole at *Sherman Mining Company's* property in Okanogan County, Washington's Ruby mining district penetrated four ore-bearing veins in going down about 150 feet. First vein was encountered at a depth of 16 feet. Good values were reported in lead, zinc and silver. The veins will be intersected by a proposed shaft. A combination office and crew quarters building and another building to serve as compressor room, shop and framing shed have been completed at the shaft site. W. E. Sherman is vice president.

Directors of *Hunter Creek* and *Inspiration Lead* mining companies of Spokane, Washington have approved a merger with *Dayton Consolidated Mines Company* of Nevada. Stockholders were asked to ratify the contract. The Spokane firms have acquired 51 percent stock control of the pre-World War II gold producer which is suing the federal government for $1,500,000 damages allegedly suffered from the War Production Board order which closed gold mines. L. Howe is president of Hunter Creek and C. C. Anderson, secretary.

Clayloon Uranium Company has entered into an agreement with *Dawn Uranium and Oil Company* for exploratory drilling of the latter's *Weiber-Wisemore* lease in the Mount Spokane district. Herbert Sams of Elk, Washington was awarded the wagon drilling contract. Clayloon also has been carrying on bulldozing and drilling of its own holdings when winter weather conditions permitted. The firm has leased 6,000 acres, mostly in Stevens county. Byrl Goodwin of Spokane is president.

First uranium exploration shaft in the Spokane area has been undertaken by a four-man crew working for Los Angeles interests who have acquired a considerable number of leases in the Spokane area during the last six months. At last report, the shaft was down 25 feet in milling-grade autunite in a fractured zone. The site is a lease acquired from Ira C. Tester, Spokane, about five miles south of the *Daybreak* mine in the Mount Spokane District. Robert Martin of Los Angeles is field representative, and Arthur J. Watson, Grand Junction, Colorado, consulting mining engineer and geologist.

North Star Uranium, Inc. has joined the list of shippers from the Spokane area. The initial carload of autunite ore was mined by bulldozer from open cuts on the recently acquired *Lehmbecker* lease in the Mount Spokane district. It went to *Vitro Uranium Corporation* at Salt Lake City. Ron McKelvie of Calgary is president, and A. C. Townsend, office manager.

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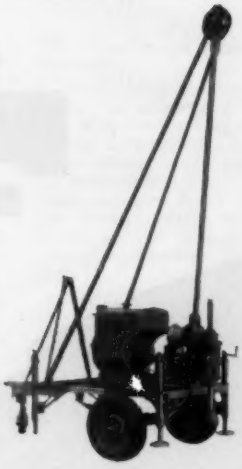

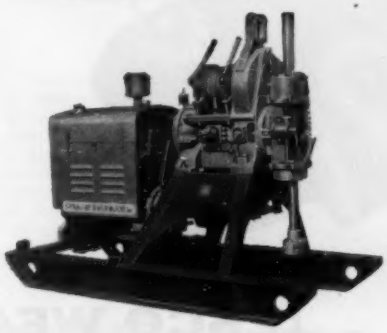

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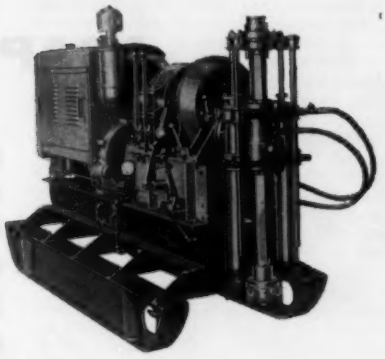

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Ore shipments have started from the new *Calamity Creek Uranium Corporation* mine on Calamity Mesa about 65 miles southwest of Grand Junction, Colorado. It is being developed as a joint venture with *Boyles Brothers Drilling Company*. The ore body is located in the *Cottonwood No. 2* claim, one of 15 contiguous claims owned by the firm. Drilling last year delineated an ore body estimated at 4,500 tons.

Gunnison Minnig Company of Gunnison, Colorado has set October 1, 1957 as the date for completion of its new uranium processing mill to be built near Gunnison. This will also be near the firm's *Los Ochos* mine where development operations are continuing throughout the winter months.

By December of last year, after several months of operation, production from the Irene shaft at Leadville, Colorado had reached 300 tons per day. Most of the output came from stope development and preparation. Underhand open stoping is now underway, using roof bolts, wire fencing, and gunite for back and rib support. If this method of ore extraction proves satisfactory, it will have a great bearing on future operation. The project is a joint venture of *American Smelting and Refining Company* and *Resurrection Mining Company*. The latter is a wholly owned subsidiary of *Newmont Mining Corporation*. In August production started from the Hellena and Julia Fisk shafts. Operations from the Hellena ceased in December and it was leased to Froelich Kaiser who is currently producing 500 tons of fissure ore monthly. The No. 2 unit of the Resurrection mill is in operation at a rate of 450 tons a day. If enough ore is developed, the No. 1 unit will also go into operation bringing capacity to about 800 tons daily.

The *Colorado School of Mines* will sponsor the Second Annual Symposium on Rock Mechanics at Golden, Colorado on April 21 through 24. The conference theme is "Behavior of Materials in the Earth's Crust." For additional information, write to the Department of Mining Engineering at the Colorado School of Mines, Golden.

Production of uranium ore and uranium oxide nearly doubled in the last six months of 1956, compared with the corresponding period of 1955. The *U.S. Atomic Energy Commission* reports that 1,660,000 tons of ore were produced compared with 840,000 tons in the last half of 1955. Twelve privately owned mills with a capacity of 8,960 tons annually produced 3,400 tons of uranium oxide in this period, compared with 1,600 tons in the same period of the previous year. The commission estimates that there are about 60,000,000 tons of known ore reserves in the United States.

J. Selby Young and associates will reopen the 17 old gold mines in the Cripple Creek-Victor area of Colorado. Ore will be taken out through retimbered shafts of the *El Paso* mine on Beacon Hill. The mines were purchased from Thomas Copeland of Colorado Springs and James Knight of Chicago for about $50,000.

The DMEA recently approved the following contracts for exploration in Colorado: G. R. Bennett, et al, $24,030 for exploration for lead-zinc in Gunnison County; *Grapevine Mines Inc.*, $16,600, uranium in Jefferson County; *Crown Uranium Company*, $15,800, uranium in San Miguel County.

The *Yellow Queen Uranium Company* of Denver Colorado is reported to have shipped about 200 tons of uranium ore from properties in the Kenosha Pass area. The company is developing 14 leased claims scattered through Park County.

Tri-Em Corporation is currently operating two mines in the Bonanza district for lead-zinc-silver ore. A new mill was placed in operation in December.

International Minerals and Chemical Corporation's feldspar grinding plant at Keystone, South Dakota was completely destroyed by fire in January. The plant had a capacity of about 2,500 tons of pottery grade feldspar monthly. No decision has been announced on rebuilding of the plant. Meanwhile, the company will continue to purchase and mine feldspar in the area.

Western Gold & Uranium, Inc. has completed its silver mill and initial processing of uranium-silver ore at its *Silver Reef* property near Leeds, Utah. A uranium section of the mill should be completed and in operation shortly. The uranium-bearing ore, after extraction of the silver, will be shipped to *Vitro Uranium Company's* mill at Salt Lake City. This combined milling operation will be carried on at a rate of 50 tons per day.

Atomic Resources Corporation of Dallas, Texas has placed its new 100-ton-per-day upgrading unit in operation on the *Waterfall* claims in the Dry Valley area of San Juan County, Utah. The plant is similar to that in use at *Vanadium Corporation of America's* mine in Monument Valley, Arizona. The basic circuit is a crusher, secondary crusher, ball mill, classifer, thickener, classifer, and filters. Thus far, the plant has been operating on a 6.6-to-1 ration with 78 percent recovery. Engineering work is being carried out on a yellow cake unit. Ore supply comes from the company's own claims, but the firm hopes to process other ores after obtaining approval from the AEC.

Haile Mines Corporation of New York City has established western geological headquarters in Salt Lake City. Dr. Eugene Callaghan, formerly director of the Bureau of Mines and Resources of the *New Mexico Institute of Mining and Technology*, heads up the new office. Also setting up headquarters in Salt Lake is *Hidden Splendor Mining Company*, wholly owned subsidiary of *Atlas Corporation*. Otto Rohlfs is general manager. The firm moved from Grand Junction, Colorado.

Hecla Mining Company of Wallace, Idaho has abandoned exploration of the *Big Flat-Tucker Flat* claims in the Big Indian District, San Juan County, Utah after drilling of 12 test holes to depths of between 832 and 1,105 feet. The 30-claim property is 1½ miles northwest of the *Radon* uranium mine which Hecla is operating for *Federal Uranium*. It is owned by *Uranium Mines, Inc.*, of Wallace.

Lisbon Uranium Corporation has bottomed its Ike shaft at 580 feet in the Big Indian District of San Juan County, Utah. Full-scale production from the two-compartment shaft is expected to average 250 tons of ore daily. Surface installations have been completed at the Columbia shaft, to the north of the Ike. This shaft will provide access to the *Dirty Dish, Patty Ann*, and *Judy Lee* claims. It will be a two-compartment, also, and will bottom at about 570 feet. The latter claims are lower in grade than the *Ike and Nixon*. *Boyles Brothers* is doing the shaft sinking.

The *U.S. Atomic Energy Commission* will close its uranium ore buying station and sampling plant at Marysvale, Utah on March 15. The station has been in operation since 1950 when it was established to stimulate development in that district by providing a market for the ore. *Vitro Uranium Company* of Salt Lake City has purchased for treatment a substantial part of the ores delivered to the Marysvale depot. Most of the mines in the area are now selling their ores directly to Vitro or to the AEC at Salt Lake City. According to the AEC, the continued operation of the Marysvale buying station constitutes an unnecessary step in the movement of ore from mine to mill.

Steady ore shipments are being made from the Colorado River uranium property at Hatch Point, San Juan County, Utah, by the operators, *Sidney Mining Company* and *Mascot Mines, Inc.* of Kellogg, Idaho. Ore is going to the Monticello processing plant. The firms also hold an option of the 36-claim *Rocky* group adjoining the *Ransom* mine near Blanding. Malcolm C. Brown is president of both firms.

Southwestern Mining Company of Phoenix, Arizona has taken a lease option on 105 claims in the area of the junction of the Green River and Colorado River. The claims are in Wayne and San Juan Counties, about 45 miles from Moab, Utah. Outcroppings of commercial grade carnotite are reported on several of the claims. The lease option was negotiated with S. D. Durham, the locator of the claims.

Stanley Cohlmeyer of the San Francisco office of *Columbia-Geneva Steel Division, U.S. Steel Corporation*, has been named project manager for the company's rapidly developing testing program on its large, low-grade iron ore deposit in central Wyoming, near Lander. Two pieces of legislation now under consideration by the Wyoming Legislature, at the request of Columbia-Geneva,

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would give the firm permission to use stream water for industrial purposes and to construct, own, and operate a mining railroad. Approval of both measures is expected. To develop its prospect, Columbia-Geneva has reported it will have to construct a railroad from the mine some 50 miles to the south to connect with the Union Pacific Railroad. Depending upon test results, Columbia-Geneva is considering erecting a magnetic separator plant to process the magnatite type ore and then ship it via railroad to its blast furnaces at the Geneva plant at Provo, Utah. *Centennial Development Company* of Eureka, Utah is presently driving an exploratory drift and will conduct test drilling in the spring under contract with Columbia-Geneva.

The Hot Springs County REA has announced it will build a power line into a remote area of central Wyoming to serve the state's two uranium mills. The line will be built 25 miles to serve the mill of *Lucky Mc Uranium Corporation* and then for another 25 miles to the south to provide service to the mill of *Lost Creek Oil and Uranium Corporation*. The project, which will also provide service to other mining companies, will cost about $600,000.

The *Wyoming Natural Resource Board* reports that national and international shortages of strategc minerals have awakened new interest in Wyoming's undeveloped deposits.

The *U.S. Geological Survey* has opened an office in Lander while field checks are made for revisions to bring topographical maps of central Wyoming up to date. Kenneth Cox is resident engineer.

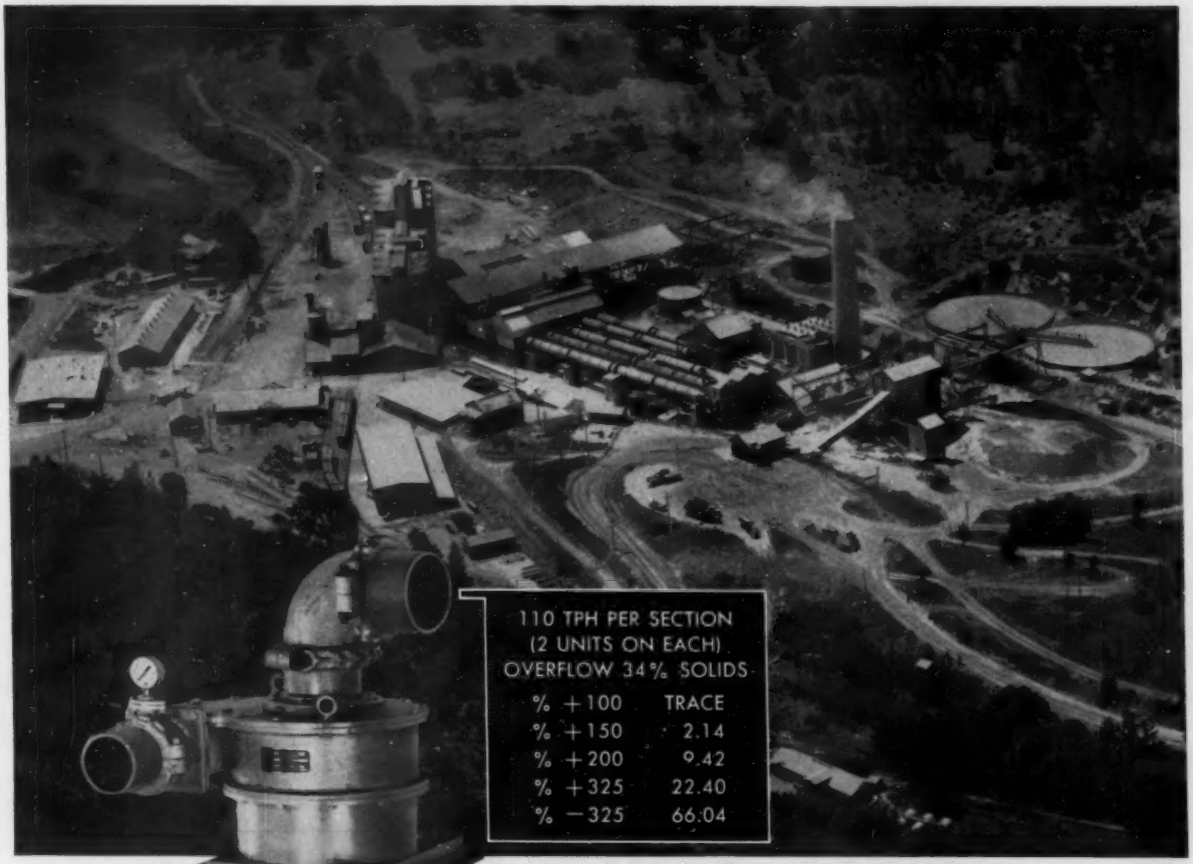
As recommended by the *Wyoming Mining Association*, bills to create a Wyoming Department of Mines and to adopt a State mining code for mines other than coal are being considered by the Wyoming Legislature. The mining association informed the Legislature that both are needed due to the resurgence of mining activity, led by the active uranium development.

Accelerated tax amortization has been approved by the Office of Defense Mobilization on *Lucky Mc Uranium Corporation's* uranium processing mill in the Gas Hills area of central Wyoming. The company has received a certificate of necessity on an $8,127,050 project, of which 80 percent was allowed for rapid amortization.

Rocket Mining Corporation of Salt Lake City, Utah is completing an engineering study of the *Pioneer-Carrisa* flotation gold mill at South Pass City, Wyoming, towards possible conversion to a uranium processing mill.

Vipont Minerals Company of Lander, Wyoming has purchased for $20,000 cash the 10 percent royalty to 32 uranium claims in the Gas Hills area of central Wyoming. Sellers were Bud Blonder and Ken Smith, both of Lander.

Lost Creek Oil & Uranium Company, which is building a uranium processing mill in the Sweetwater Valley of central Wyoming, near Crooks Gap, has increased its uranium property holdings in the Gas Hills area, some 25 miles to the north. Robert Adams, president of the firm, announced purchase of the 12 claims and the mine on the *Bull Rush Group* from *Savanna Construction Company* of Savanna, Illinois and four businessmen, three from Savanna and the other from Laramie, Wyoming. The purchase price



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was not disclosed. The mine has been one of the leading Wyoming uranium producers for more than a year, although operations have been closed down recently due to extremely cold weather. Mr. Adams said his firm hopes to start a large stripping operation this month with an intense production program to follow. The main ore body is to be exhausted by next Fall, with the ore going to the site of the Lost Creek mill, which is slated for completion next Summer.

A two-year project to sink the iron ore shaft at *Sunrise* mine in eastern Wyoming by 160 feet is underway by *Colorado Fuel & Iron Corporation*. The shaft is expected to make possible the development of a seventh level. At present, the mine said to be shipping about 3,200 tons of ore a day to the Pueblo, Colorado, plant.

Phelps Dodge Corporation has opened an office for its Wyoming operations at Lander. Elton "Skip" Clark, who has been in charge of the firm's activities in the Crooks Gap area of Fremont County, is in charge of the new field office. Mr. Clark reports information gained during extensive drilling operations on property of *Mile High Minerals Corporation* of Denver, and *Wyoming Uranium Corporation* of Lander, will be studied during the winter as a basis for planning operations for next summer. Phelps Dodge has closed down its Crooks Gap operation for the winter. Part of the crew has been moved to the South Pass area, some 40 miles to the west, to make a preliminary survey of two school sections held by Wyoming Uranium. The sections are part of the property on which Phelps Dodge has an option.

The AEC has opened a provisional uranium ore-buying station at Crooks Gap, Wyoming to provide a market for Gas Hills and Crooks Gap ores amenable to the Lost Creek Plant. These ores will no longer be purchased at the Riverton, Wyoming buying station. *Lucius Pitkin Inc.* will operate the provisional station until permanent automatic sampling facilities are completed by the *Lost Creek Oil & Uranium Company* sometime in the spring of this year. The permanent sampling plant will be leased to the commission by Lost Creek until the processing mill is completed, at which time Lost Creek will take it over to purchase ores for its own account.

A committee to prepare way for publication of a textbook on mining law has been appointed by W. J. Wehrli of Casper, Wyoming, president of the *Rocky Mountain Mineral Law Foundation*. The book will cover only the field of hard rock mining laws and will not purport to cover oil and gas law, except as may be necessarily incident to proper consideration of law relating to hard rock mining. Chairman of the committee is Prof. Clyde O. Martz of the University of Colorado at Boulder.

A uranium-selenium prospect in the Pumpkin Buttes area of Wyoming is being examined by *Painted Desert Uranium and Oil Company* of Spokane and promising outcrops have been found. W. M. Fredericks is secretary.

Peter Kiewit Sons Company of Sheridan, Wyoming is a new operator in Gas Hills uranium activity, having taken a one-year drilling option on 48 claims from *Gas Hills Uranium and Development Company* of Lander, Wyoming. *Sprague and Henwood* is the drilling contractor, with work already under way.

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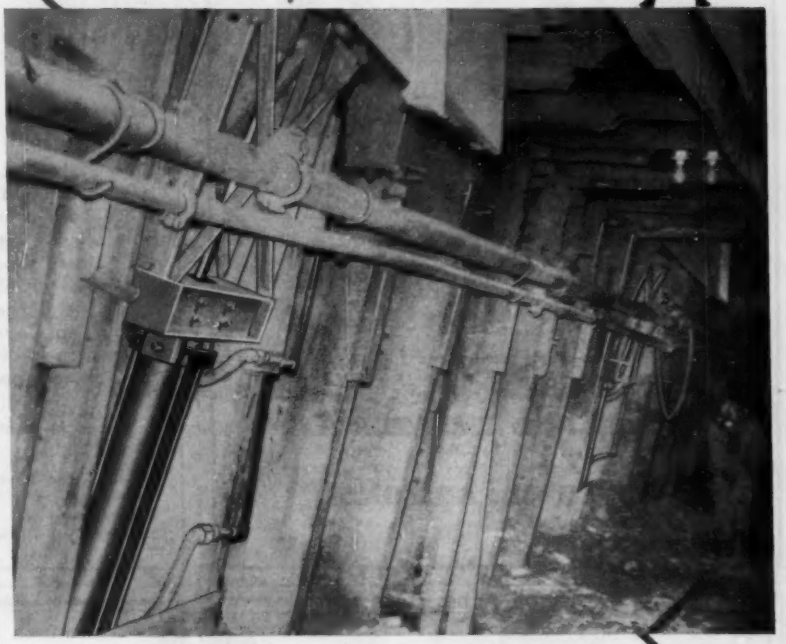

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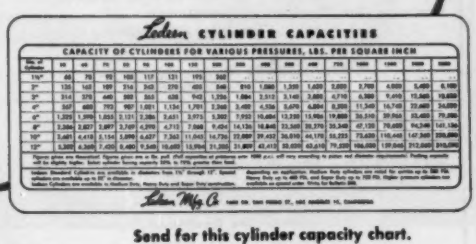
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Inspiration Consolidated Copper Company at Inspiration, Arizona placed its converted concentrator in operation in January. The mill had been completely rebuilt and modernized to the so-called "dual process." The latter is expected to increase tonnage of ore treated by 50 percent, thus extracting in excess of 16,000 tons per day.

Magma Copper Company reports that at year's end (1956) production at its subsidiary firm, *San Manuel Copper Corporation*, remained at the rate of about 65 percent of its contemplated full production as it was at September 30, 1956. Mining operation was proceeding satisfactorily, but several months of unforeseen delay in planned production increases had resulted from loss of use of one of two main ore hoists because of factory defect in electrical equipment. The equipment has been rebuilt by the manufacturer and is being put back into service.

Industrial Uranium Corporation has completed drilling of three properties in Navajo County, Arizona and reportedly has located ore bodies containing some 500,000 tons of average grade 0.30 perment U_3O_8. The deposits are in the *Moonlight, Starlight,* and *Sunlight.* A 200-foot, two-compartment shaft has been completed on the Moonlight claim and mining is underway at the rate of 4,000 tons per month. A two-compartment, 190-foot shaft is being sunk on the Starlight, and bids are out from shaft on the Sunlight. The three deposits are near the depleted *Monument No. 1* mine and about 18 miles from the producing *Monument No. 2.*

The *Serasio* group of 19 unpatented mining claims in the Twin Buttes mining district has been acquired under lease and option by the *Southwest Mining Industries*, of Tucson, Arizona. The lessees have started exploration work, the first phase of which is diamind drilling and one hole is already down 475 feet. The mine was first worked in 1912 by the present owner, Mike Serasio of Tucson. Between 1912 and 1918 he shipped 16 carloads of copper ore, and one additional carload was shipped in 1943. The ore, which was sorted before shipment, is said to have run 6.29 percent copper and 4 ounces silver. Present mine workings include four vertical shafts—50, 100, 110, and 110 feet deep—and several open cuts.

The AEC uranium ore-buying station and sampling plant at Cutter, near Globe, Arizona, will cease accepting uranium ore at the close of business on June 30, 1957. The plant has been operated by the AEC since June 1955. The Globe buying station, AEC said, has failed to stimulate the development of the district sufficiently to warrant the construction of a processing plant—the ultimate purpose of establishing buying stations. The tonnage of ore received at the buying station and the reserves developed in the district have been much smaller than was expected, and, in addition, the ore is low grade and refractory to existing processes. The few properties still operating in the area will be offered contracts to deliver ore until June 30, 1957.

The *Lewisohn Copper Corporation* of Tucson, Arizona, has contracted with the *Purcell Drilling Company* for a program of churn drilling at the *Peach* group of six patented claims near Helvetia. The first phase of the exploration calls for the sinking of 24 churn drill holes to an average depth of 300 feet, or a maximum of 7,200 linear feet of drilling. This work is being financed under a DMEA contract, the cost of the project being estimated at $88,780 with government participation limited to $44,390. If the results of the drilling program are favorable, additional DMEA assistance probably will be sought. Prior to the start of work under the present contract, Lewisohn Copper had put down about 30 diamond and churn drill holes to average depths of 300 feet each. The company owns or controls more than 100 patented claims in this area. Among the officers of the company are Richard E. Chilson of Tucson, president; and B. H. Martin, manager.

Over 50 percent of the estimated 400,000 tons of excavation needed for the *Kennecott Copper Corporation's* new smelter site at Hayden, Arizona has been removed. Equipment purchases for the project, which is under the supervision of the Ray Mines Division, now total over $4,500,000. Construction of garages and concrete batching plant are under way in north Hayden. The expansion program was started in April 1956. It is expected that the work will result in a 20,000-ton increase in annual copper production by 1958. The expansion includes extension of mining limits in the pit, relocation of the Mineral Creek, and relocation of many surface installations.

Exploration is still underway at *Coso Uranium Inc.'s* uranium claims in the Coso Range east of Olancha in the Mojave Desert of California. *Colorado Exploration Company* of Grand Junction, Colorado has the contract for the drilling. The firm has recently filed on 127 additional claims east of company property on Cactus Flat. With holdings on the west side of Haiwee Ridge, the firm now holds approximately 3,000 acres. An exploration program is planned for the Cactus Flat area.

Black Mammoth Consolidated Mining Company of Toronto, Canada has terminated its management contract with *Sonoma Quicksilver Mines Inc.* of Guerneville, California. Black Mammoth had carried out a program of exploration and development at Sonoma's mercury property near Guerneville.

A large ore body of low-grade cinnabar has been opened up above the old *Lee Grant* workings on the *Manuel Ortiz* lease in Panoche Valley, California. Diamind drilling is in progress and ore is being trucked to the *New Idria* mine, 18 miles south. The lease is being operated by R. A. Fones of the *Acme Drilling Service.*

The United States Geological Survey has released a reconnaissance geologic map of a large previously unmapped area of southeastern Mojave Desert. It covers an area of about 3,500 square miles in southeastern San Bernardino County, California. The rocks are mapped in three broad groups. The oldest rocks are pre-Cenozoic igneous and metamorphic rocks, differentiated into eight types. The older Cenozoic rocks, which are mostly of volcanic origin and have been locally folded and faulted, are subdivided into 20 separate units. The younger Cenozoic rocks, divided into 16 units, are mostly gravels, sands, and clays, but also include Recent basalt cones and flows. The major structural features of the region are shown. The map has been placed in open file in the libraries of the Geological Survey in Washington, D. C., Denver, Colorado, and Menlo Park, California; in the offices of the Geological Survey, Claremont, California, and 1031

United States Borax Builds Research Lab

Now under construction at Anaheim, California is this $850,000 research laboratory for United States Borax & Chemical Corporation. The lab will conduct research for all three operating divisions of the firm—Pacific Coast Borax Company Division, United States Potash Company Division, and 20 Mule Team Products Division. It will be fully equipped for all phases of chemical research. In addition to standard laboratories, special facilities will be provided as follows: distillation room, instrument laboratory, heavy experimental equipment room, and a greenhouse for agricultural investigations. Completion is expected by late April 1957.

Atlas Copco produce world's lightest motor drill

From Atlas Copco, the world's largest manufacturers of pneumatic rock-drilling equipment, comes an entirely new motor drill. It is the Atlas Copco *Cobra*, backed by 50 years' experience of rock-drilling equipment, and developed after extensive field tests.

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The right steels for the Cobra

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Bartlett Building, Los Angeles, California; and in the office of the California Division of Mines, San Francisco, California. Interested persons can inspect the map in these offices, but copies are not available for distribution at this time. All copies are uncolored except at the Geological Survey office in Claremont.

NEVADA

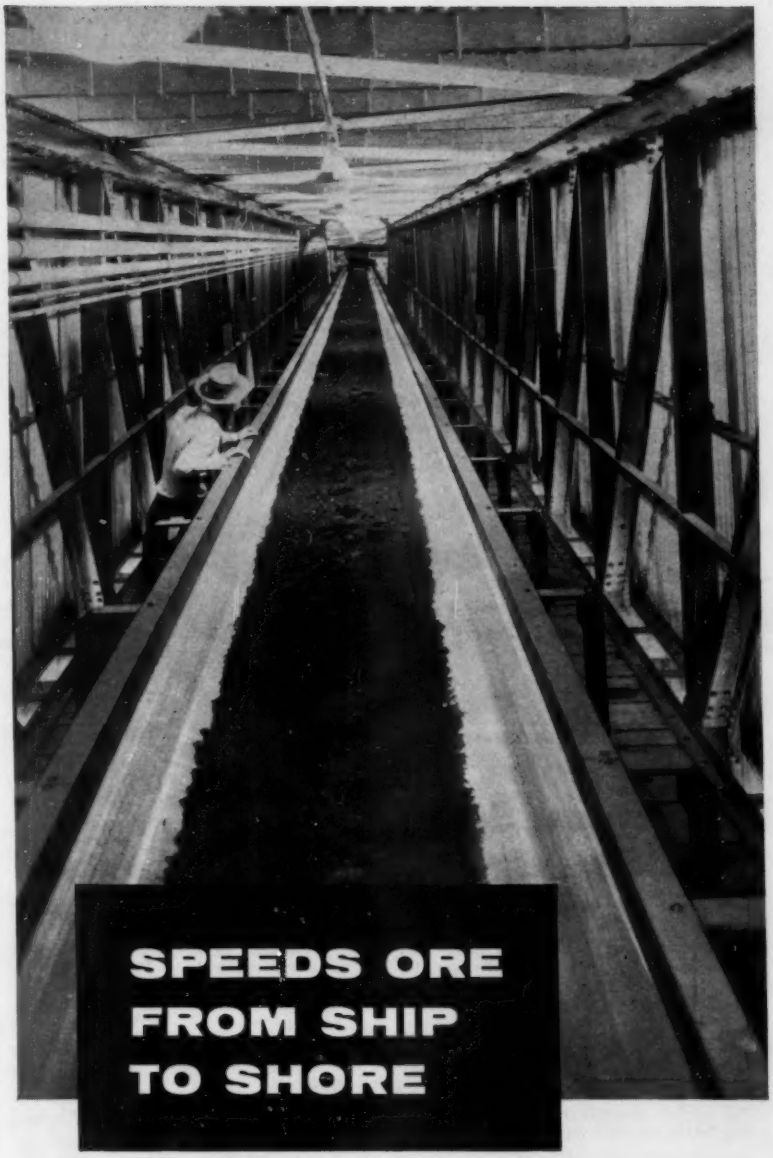
According to R. G. Johnson, president of *Dixie Valley Mining Company*, a 50-ton cyanide mill is planned for the Dixie Valley area of Nevada by his firm. Reportedly there is enough silver and gold ore in sight on the company's property to merit installation of the mill.

A uranium processing plant reportedly will be erected at Millers, Nevada, just outside of Tonopah. The *Benjamin Corporation* is said to be building the unit and to have purchased key equipment from *Consolidated Uranium Inc.* at an auction at the side of the former *Lindsay* mill, 35 miles west. Included was grinding and crushing machinery, as well as conveyors, motors, and a Diesel power plant. The mill is being erected on property owned by *Desert Mines, Inc.*

The first *Pacific Southwest Mineral Industry Conference*, sponsored by the Nevada Section of the AIME, and co-sponsored by the Los Angeles and San Francisco Sections of the AIME, will be held in Reno, Nevada, April 5 and 6. Four technical sessions will be held on April 5, at which papers on geology, mining, and metallurgy will be presented, as well as an industrial minerals symposium. Field trips are scheduled for April 6 to the diatomite mine and mill of *Eagle-Picher Company* at Clark Station, as well as the open pit gypsum mine and board plant of *U.S. Gypsum Company* at Empire. Another trip will be made to the open-pit copper mine, leaching plant, and sulphuric acid plant of *Anaconda Company* at Weed Heights, returning by way of Virginia City. Additional information may be obtained from William P. Johnston, registration chairman, 3200 West Plumb Lane, Reno.

NEW MEXICO

Stockholders of *Sabre-Pinon Corporation* have approved a plan to form a uranium mining and milling limited partnership with *Homestake Mining Company*. Under the proposal, Homestake will mine and develop three sections of Sabre-Pinon properties in the Ambrosia Lake area of New Mexico. Homestake will also undertake to build and operate a 1,500-ton-per-day uranium ore processing mill. Homestake will lend the partnership about $2,000,000 for initial operations, and would hold a 25 percent interest as a general partner. Sabre-Pinon would hold a 75 percent interest. Consummation of the partnership now awaits approval from the AEC of a contract for the mill. Sabre has already obtained water rights from the Valencia Corporation.



This Hewitt-Robins slope conveyor takes ore from a 48" H-R dock conveyor which runs the length of the Canton Railroad ore pier in Baltimore. It carries 3,000 tons of ore per hour up a 16° slope into a weighing station for loading into railroad cars.

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SOUTHWEST

Rio de Oro Uranium Mines, Inc. and *Yucca Uranium, Inc.*, both of Albuquerque, New Mexico, have signed a long-term exploration and development lease covering a 460-acre tract in the Ambrosia Lake district. The property is located in Section 9, Township 13 North, Range 8 West. In effect, Rio de Oro has assumed the mineral leasing rights previously assigned by Yucca to the *Joplin Machinery Company*. Drilling will start immediately.

United Western Minerals Company of Santa Fe, New Mexico, together with *J. H. Whitney & Co., White, Weld & Co., San Jacinto Petroleum Corporation, Norbute Corporation, Sabre-Pinon Corporation*, M. O. Brown, and A. F. Boyd, has signed an exploration agreement whereby *Phillips Petroleum* will acquire a half interest in approximately 50,000 acres of land in the Grants area in return for conducting exploration work. A program of surface geological surveys and exploratory drilling, which may extend for two years or more, will be started in the near future. United Western is contributing about 60 percent of the acreage.

Preliminary work on a millsite for a 100-ton per day scrap mica mill has been started in the Petaca mining district of New Mexico by *Columbium Milling & Mining Company, Inc.* The mill is expected to cost $100,000. The New Mexico Economic Development Commission has given considerable attention to development of mica deposits in the Petaca district.

An $80,000 mill to recover free gold, metallic copper, iron, oxides and carbonates is under construction 15 miles east of Isleta Indian Reservation and about the same distance from Albuquerque, New Mexico in the foothills of the Manzano Mountains. Around the turn of the century considerable mining was going on in these mountains. Part of the area has recently been monopolized by the AEC's special weapons project at Albuquerque. The mill is being built by *International Uranium Corporation;* Clifford Taylor of Albuquerque is president.

James McGregor of Dallas, Texas has announced the sale of his interest in the *Austin-Amazon* group of patented claims about eight miles west of Tyrone, New Mexico to the *Norbute Corporation* of New York City. This gives Norbute control over the entire group of claims. It has invested around a million dollars to get them. Test shipments of 200,000 tons from the property have shown good returns. *Phelps Dodge Corporation* formerly operated open-pit copper mines at Tyrone, which was built as a company town. Austin-Amazon is expected to open offices in Silver City.

Frontier Chemical Company of Wichita, Kansas reportedly plans to build a caustic soda plant in Grants, New Mexico. *Dow Chemical Company* is also said to be negotiating for 40 acres of land near Grants for a similar plant. Caustic soda is used in the processing of uranium and presumably would have a good market in this area.

The first shipment of uranium ore by the *Lone Star Mining & Development Company*, from an abandoned copper mine site 19 miles southwest of Santa Fe, New Mexico has gone to Grants for testing. W. L. Davidson, president of the company, said the test shipment consisted of 50 tons of primary ore and that he hoped it would average from a half to one percent uranium.

New Manganese Company To Process Rhodonite

A new company, U. S. Manganese Corporation, has been formed to produce manganese from domestic rhodonite and has received a $270,541 contract from General Services Administration, extending 19 months.

Vitro Corporation owns 40 percent of the new company and Sheer-Korman Associates has a 40 percent interest. Vitro Laboratories Division will equip, operate, and maintain a pilot plant in its West Orange, New Jersey, laboratory to develop the economic factors for full-scale production by the Sheer-Korman high intensity arc process of metallurgical-grade manganese from rhodonite.

Great Divide Mining and Milling Corporation has a 20 percent interest in the company and will supply the ore from its several hundred million ton deposits of rhodonite ore near Silverton, Colorado.

Rhodonite is a highly refractory, manganese-rich ore which exists in large quantities in Colorado. Prior to the Sheer-Korman process, it has not been economically suitable for development. Laboratory test runs indicate that treatment of rhodonite with the arc makes the ore amenable to manganese recovery by conventional methods.

Strategic Materials Corporation is now operating a pilot plant with another process for use on low-grade ores at Niagara Falls, Ontario.

U.S. Mineral Production Hit New Peak in 1956

The value of mineral production in the United States reached a new high of $17,300,000,000 in 1956, a gain of more than a billion dollars over 1955. A Bureau of Mines year-end report shows that the 1955 total was nearly $16,000,000,000, and $14,100,000,000 for 1954.

Although an increase in total value was due mostly to greater production, price rises for some commodities also contributed. Most prices, however, were steady during the year, says the Bureau.

Fuels value rose 11 percent, compared with a 10 percent gain for other nonmetals and 9 percent for metals. The increase for metals was due mainly to greater output of copper, lead, and zinc. Offsetting the general upswing were drops in production and value for such metals as chromite, gold, iron ore, manganese ore, molybdenum, silver, and tungsten.

Other highlights of 1956 reported by the Bureau were:

Reserves of nuclear fuel appear ample. Domestic uranium ore reserves were estimated at about 60,000,000 tons as of November 1, 1956. The ratio of private to government drilling for uranium increased from 10 to 1 in 1955 to 200 to 1 in 1956 and is expected to continue in that direction.

Production of titanium sponge metal nearly doubled during the year and substantial price reductions were achieved. Domestic aluminum output also reached a new high.

Strong demand drove the price of copper to a 90-year high of 46 cents a pound in February, a level it held until July. Then a sharp dip to 36 cents occurred and by year end some operators were curtailing output.

Operating at high capacity in the last months of the year, the steel industry managed to fill most demands, despite the month-long midsummer strike. Iron ore output, though down eight percent, was aided by extending the Great Lakes ore fleet-shipping season two weeks.

Output of nearly all the nonmetals increased along with growth and stepped-up activity in the construction, chemical, ceramic, and fertilizer industries. Major gains were in the aggregate industries and phosphate rock. Higher phosphate rock production reflected continued demand for fertilizer materials and the industry's recovery from strikes which had curtailed 1955 output.

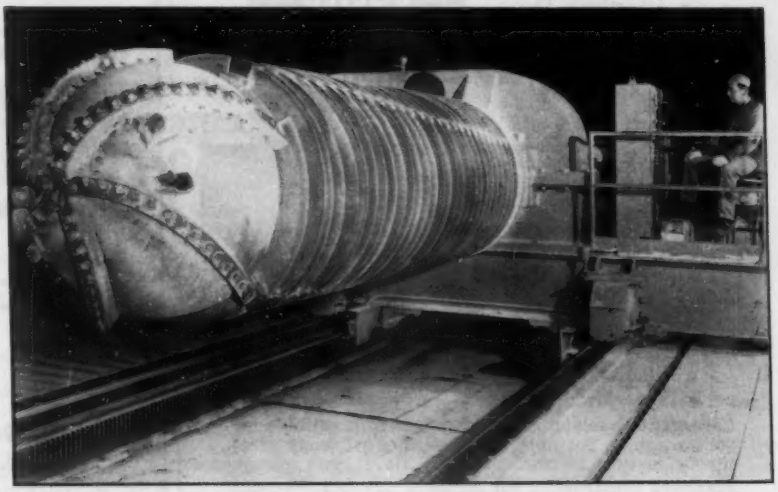
Substantial deposits of gypsum are reported in the Ottumwa area of Iowa. One reportedly is 125 feet thick and the other 120 feet thick. They are said to average 75 percent pure gypsum. This is confirmed by Dr. H. Garland Hershey, state geologist and director of the *Iowa Geological Survey*. Interested persons may write to the Survey at Iowa City or to the Chamber of Commerce at Ottumwa, Iowa.

The *Institute on Lake Superior Geology* will meet on the campus of *Michigan State University* at East Lansing, Michigan on May 6, 7, and 8. Co-sponsors of the event, along with the geology department of the University, are the Exploration Subsection of the Upper Peninsula Section of the AIME, the Michigan Geological Survey, and the Michigan Geological Society. The theme for this meeting is "Modern Research Techniques and Stratigraphic Concepts Applicable to Pre-Cambrian Geology."

Fansteel Metallurgical Corporation has appointed the *Dickmann-Pickens-Bond Construction Company* of Muskogee and Little Rock, Oklahoma, as general contractor for the $6,500,000 tantalum-columbium plant to be erected on a 113-acre site near Muskogee. The new facilities will supplement those already in operation at North Chicago, Illinois, and will increase tantalum capacity by 50 percent, and columbium capacity by 150 percent.

The *Joint Committee on Defense Production* has revealed in its sixth annual report that the minimum objective has been reached on 47 of the 74 materials being stockpiled. Six additional materials are more than 75 percent complete; eight more than 50 percent complete; five more than 25 percent complete; and eight for which the minimum is less than 25 percent complete. Of the 228 expansion goals established since 1950, 17 goals remain open. The mineral commodities are: chromite, chemical grade; manganese, battery and chemical grades; mercury; nickel; and selenium.

The 750-ton mill at the *Ore Knob* copper mine in Ashe County, North Carolina



Capacity Output Reached at Titanium Sponge Plant

Electro Metallurgical Company's titanium sponge plant in Ashtabula, Ohio has reached capacity production of 7,500 tons of titanium sponge annually. Electro Metallurgical is a division of Union Carbide and Carbon Corporation. The plant is the first in the United States to produce titanium metal sponge commercially by the sodium-reduction process rather than the magnesium-reduction method. It reached capacity in less than nine months after the first "heat" or "batch" of sponge was produced at the Ashtabula. A part of the process is removal of "spalt," a combination of salt and titanium sponge, which clings to the sides of the reactors. In the photograph above, a huge product removal machine is carrying out this operation. At right, an operator at the control board actually directs operation of this machine. Titanium production has grown at a rapid rate in the last few years. From an output of a mere three tons in 1948, the United States output of titanium grew to 7,200 tons in 1955, and an estimated 13,000 tons in 1956. Output by the end of 1957 is expected to approach 30,000 tons annually.

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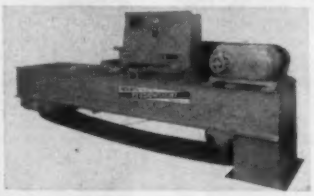

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is now in operation, reports *Appalachian Sulphides, Inc.*, a subsidiary of *Nipissing Mines Company*. The production shaft has been completed to a depth of 1,037 feet with four working levels established at 560, 700, 840, and 980 feet. Three of the levels are said to be already in ore. In addition to a copper concentrate, the Ore Knob will also produce a pyrrhotite concentrate that will run 40 percent sulphur. The company is also diamond drilling the *Elk Knob* property, 35 miles southwest, which it holds under lease. At the company's *Elizabeth* mine in Vermont, mill tonnage has been cut from 22,000 tons to 15,000 tons monthly. This has resulted in raising the grade, a step brought about by the lower price of copper. Some 40 miles from this operation, the company is diamond drilling a copper-zinc prospect called the *Milan* property.

The domestic primary aluminum industry broke all previous records in 1956 with an annual output of 1,679,431 tons, an increase of seven percent despite a crippling strike during the summer. Production in 1955 had totaled 1,565,719 tons. A new quarterly record was set in the last three months of the year with an output of 442,781 tons, an increase over that set in the second quarter with 441,253.

Kings Mountain Mica Company has placed its new plant in operation on the *Charlie Moss* property south of Kings Mountain, North Carolina. The plant will produce scrap mica. The company holds a lease on 200 acres which is estimated to provide sufficient reserve for 25 years of operation. Paul Lancaster is manager.

Metal and Thermit Corporation is developing a $3,000,000 to $4,000,000 mine and ore dressing plant at Beaverdam, near Ashland, Hanover County, Virginia. Full operation is expected to begin this fall. Ilmenite and rutile ores have been found at the mine site and these will be mined by open pitting. Currently under construction is a 4,000-foot access road from the highway to the pit. Ore will be trucked to a nearby rail point, probably at Ashland, for shipment to the firm's branches at Rahway, New Jersey, East Chicago, and San Francisco. Other mines are being opened in New Jersey, Kentucky, and Toronto.

A strike at *Woodward Iron Company* at Birmingham, Alabama entered its fourth month in February with no settlement in sight. A deadlock had developed over a union proposal to obtain an incentive wage plan in a new three-year contract. 2,500 workers have been idled.

The *American Society of Photogrammetry* and the *American Congress on Surveying and Mapping* will hold consecutive meetings and a co-exhibit at the Shoreham Hotel in Washington, D.C. the week of March 3 through 9. Among the many interesting subjects announced are these: Experiments in the Use of Color Photography for Geologic Study, presented by Bion H. Kent, U.S. Geological Survey; Analysis of Photointerpretation of a Complex Geologic Terrain in Southeastern Alaska, by William H. Condon of the U.S. Geological Survey.

Geologists of the *Oliver Iron Mining Division* of the *United States Steel Corporation* have been exploring the east coast of the United States from Maryland northward to Maine for the past four years. One property, now under option, is the famous old *Edison* mine in New Jersey which was opened by Thomas A. Edison in the late 1880's. Mr. Edison is

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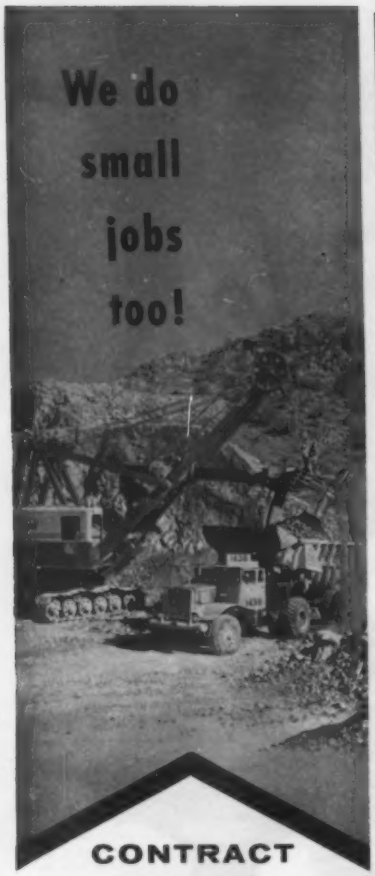

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CENTRAL AND EASTERN

reported to have developed a process for concentration of the low-grade magnetic ore on the property into a saleable iron concentrate. The process is said to have been similar to that now used for concentrating taconite. The venture failed because of the simultaneous discovery of the Mesabi Range in Minnesota with which Mr. Edison's operation could not compete cost-wise.

Piedmont Properties, Inc. of Atlanta, Georgia, has secured mineral rights to several square miles of property in Rutherford County, North Carolina, at the border of South Carolina. The rights, but not the property, were purchased from Fred McBrayer who is the last surviving officer of the old *Speculation Lands Company* which once held the mineral rights to the extensive estate of Tench Coxe, comptroller of currency under George Washington. Most of this property has since been sold. Piedmont is currently constructing a laboratory at Spartanburg, South Carolina, just across the border.

A *U.S. Bureau of Mines* report on laboratory tests at the Bureau's Southern Experiment Station at Tuscaloosa, Alabama, reveals that high-grade kyanite-sillimanite products were recovered from tailings obtained at plants producing titanium and zirconium minerals in Florida's Jacksonville-Starke area. The Bureau's tests showed that these tailings—material rejected in concentrating the titanium and zirconium minerals—can be treated by magnetic separation and flotation to produce a concentrate containing nearly 96 percent kyanite and sillimanite.

The Bureau of Mine report of its investigation of three prospects within a 12-mile radius of Mountain City, Johnson County, Tennessee has been released. For several months in 1954, the Bureau prospected the deposits, sinking six diamond drill holes totaling about 678 feet and two shafts, bulldozing 190 feet of trenches, and driving about 80 feet of report disclosed the presence of low-crosscuts and nearly 70 feet of adits. The grade manganese-bearing material.

The *American Lithium Institute, Inc.* has been established by *American Potash and Chemical Corporation, Foote Mineral Company*, and *Lithium Corporation of America* "to meet the growing necessity for a central organization staffed to direct research on problems of an industry-wide nature." The non-profit organization will maintain offices in Princeton, New Jersey. President and managing director is Marshall Sittig.

IRON RANGES

Cleveland-Cliffs Iron Company has boosted iron ore prices 60 cents gross tons, or more than five percent, for shipments of Lake Superior ores during 1957. This increase is expected to set a price pattern for the whole iron ore mining industry. Last year iron ore prices went up 75 to 85 cents a ton. New prices set by CCI are: Mesabi Range non-Bessemer grade, $11.45 per ton, for ores of 51.50 percent iron content, delivered at lower Lake ports; Mesabi Range Bessemer, $11.60 per ton; old range non-Bessemer, $11.70; old range Bessemer, $11.85; open hearth lump, $12.70.

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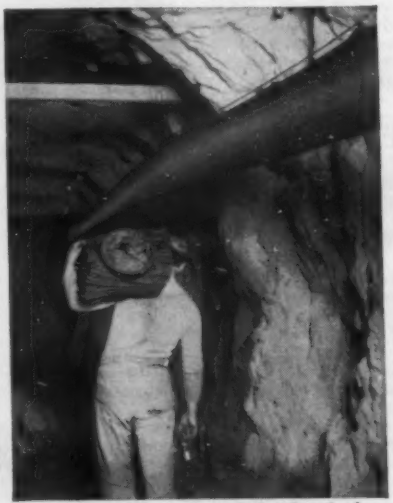

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Production of iron ore pellets at *Reserve Mining Company's* new taconite plant at Silver Bay, Minnesota exceeded 3,500,000 gross tons during its first year of operation. The 1956 figures show that the plant processed 10,775,000 tons of taconite to obtain 3,685,000,000 gross tons of pellets. In the Babbitt Division, where the *Peter Mitchell* taconite mine is located, 12,950,000 gross tons of taconite were blasted during 1956. These operations required 3,250 tons of explosives, with the largest single blast moving 406,000 tons of rock. The coarse crusher at Babbitt handled 12,000,000 gross tons during the year, while the processing plant produced 291,000 gross tons of pellets.

A winter stripping program is underway at the Minnesota operations of *M. A. Hanna Company*. Between November 1 and April 1, the firm plans to remove 16,000,000 cubic yards of material, 7,000,000 cubic yards of which will be rock and the remainder overburden. On the Mesabi Range, stripping is being conducted at the *Enterprise, Douglas, South Agnew, Morton, Carlz, Mississippi* group, *Argonne* group, *Cooley* district, and *Hunner* mines. On the Cuyuna Range, stripping is underway at the *Hillcrest Extension, Feigh, Maroco, South Hillcrest*, and *Portsmouth*. The cyclone installation at the Hunner mine will be completed this winter. At the Morton, the skip pocket will be lowered, and a rock loading bin installed. A secondary crusher is going in at the *Patrick A* plant, along with some modifications in the heavy media circuit. At the *Harrison B*, a ball mill installation was completed and changes are being made to the heavy media cleaning circuit at the *Harrison A* plant. The *Perry* screening plant has been torn down and is being reassembled at the Argonne-Leach property. At the Douglas, the surge pile system is being remodeled to provide more flexible surge facilities.

Charleson Iron Mining Company has permanently closed its concentrator at Virginia, Minnesota. This plant went into operation in 1949 and produced regularly every year thereafter. A total of 1,315,000 gross tons of concentrates were shipped from the plant during this time. Ore for the plant came from State of Minnesota lean ore piles held in reserve from past operations of the *Missabe Mountain* and the *Minnewas* mines. The 1956 operation exhausted these piles. All beneficiation was achieved through use of Remer jigs, designed by Charles H. Remer, vice president of Charleson Iron.

The Michigan Department of Conservation has granted a three-year extension to the exploration lease held by *Algomah Mining Company* of Ontonagon, Michigan on state land. The Algomah is working copper property at the old town site of Lake Mine, Michigan.

To increase the supply of good quality iron ore for the iron and steel industry, sintering facilities are being expanded more rapidly that ever before, says the *American Iron and Steel Institute*. Eighteen new sintering machines, with a total annual capacity of over 25,000,000 net tons reportedly are scheduled for completion before the end of 1957. Added to the 103 machines of all kinds now operating, the new facilities will bring national sintering capacity to an estimated 63,000,000 tons per year. All but 10 of the 103 sintering machines now used in this country are of the "moving bed" type.

Reserve Mining Company has officially changed the name of its *Reserve* taconite mine to the *Peter Mitchell* taconite mine in honor of one of the first explorers to cross the Mesabi Range. Mr. Mitchell made a number of trips into the interior of northeastern Minnesota during 1870 and 1871. He located an iron formation where it outcrops on the extreme eastern end of the Mesabi, near Reserve's present taconite operations. In 1871, Mr. Mitchell sank the first officially recorded test pit on the Mesabi and opened what was to be one of the greatest eras in the history of mining.

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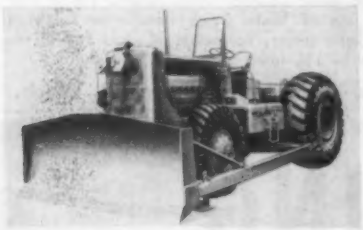
PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

Hi-G Screen Ups Tonnages With Reduced Power Cost

The 4-foot by 20-foot Hewitt-Robins' hi-G Screen shown above mounted on a traveling tripper carriage screens more than 400 tph. of asbestos ore over 1¼-inch openings. Manufactured by Hewitt-Robins, Inc., Stamford, Conn., the hi-G screen operates on a modified resonance principle and only requires a 7½ hp. motor.

These screens are recommended for scalping, sizing and washing metallic and non-metallic ores at openings ranging from 4 inches to ¾ inches. Literature describing the hi-G screen may be obtained by circling No. 73.



300-HP 4-Wheel Tractor Has Wide Use In Mining

A new 300-hp four wheel drive tractor has been introduced by the Caterpillar Tractor Company. The new machine, No. 668, combines fast travel and work speed with high tractive effort, due to the use of four-wheel-drive engineered to match the machines horsepower, speed and weight.

The No. 668 has been field tested for over three years on a variety of construction and mining jobs.

With the front wheel drive engaged the No. 668 is capable of making highly effective use of its 300-hp engine with a maximum rim-pull in first gear of 34,140 pounds. Weight of the new machine is about 43,750 pounds. 60 per cent of this weight is carried on the rear wheels. Additional weight as needed can be added by hydro-flation or counterweights. Because of its high speeds the company states that while on jobs where work areas are widely separated the machine will replace more than one of the conventional track type tractors. For further information circle No. 71.

Off-Highway Truck Offers High Power-Weight Ratio

A new off-highway truck by Autocar is designed to haul greater loads at lower costs according to the Autocar Division, White Motor Company. It is built to operate at lower costs and to have a longer operating life.

One of the major design features is the high horsepower-to-weight ratio which provides for greater loads under normal operating conditions. Maximum maneuverability with a set-back, wide track front axle give the machine an ability to make short turns under the shovel.

Options include torque converter or mechanical transmission drive, 335-hp or 375-hp Cummins diesel engine and other items designed for operator comfort. The Autocar "AP25" is engineered for top performance with a specially designed body and a planetary gear-drive rear axle that provides better axle ratios and permits heavier load capacity. Circle No. 66 for further information.

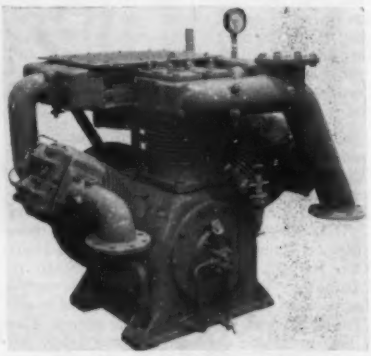
Off-Highway Truck Has Many New Design Features

A new 30-ton hauler designed as a tough, fast, high-production unit which would be cheaper to run, simpler to maintain, and easier to operate has been announced by the LeTourneau-Westinghouse Company.

In dimension the LW-30 is smaller than conventional trucks of comparable capacity and can turn in a 43-foot circle. Despite its announced large capacity the truck with full power controls is reported to be extremely easy to handle. Power steering, power brakes, power clutch and even a power seat are all standard equipment.

The new machine has many of the outstanding LeTourneau parts features built in which indicate extra strength and extra ease of operation. The unit has no springs using the "Hydair" suspension system. To make day-to-day servicing fast and simple, chassis grease fittings have been completely eliminated. Special bearings lubed and sealed at the factory need regreasing only if taken apart. Repair time is speeded up by easy accessibility of major components.

The manufacturer states that they believe this truck to be an entirely new concept in truck haulage and is the first of a full line of units of various sizes. For further information circle No. 68.



Copco Adds Lightweight Compressors to Line

Lightweight air cooled compressors in a compactly-designed medium-capacity range, the new CT series, recently developed by their Swedish affiliate, have been added by the U.S. Atlas Copco Companies in a continuing expansion of the compressor sales and service divisions.

With a Deutz air-cooled Diesel engine, a completely air-cooled compressor plant can be achieved. New models include the 45 hp CT-4 developing 175 cfm, and the 75 hp CT-6 delivering 340 cfm. Skid mounted, their weights of 1,300 and 1,900 pounds respectively, make them especially suitable for mining exploration and similar temporary location work where water supply is a problem. Both models are two-stage, single-acting types which develop their rated capacities at 970 rpm. Circle No. 63.

SPANISH CASTINGS BROCHURE: American Brake Shoe Company has just published a six-page brochure in Spanish covering bronze castings, bronze bars and babbitt. This booklet provides ordering information on cored and solid, rough and machined, round and hexagonal 13-inch bronze bars. Properties and applications of lead base, nickel base and silver base babbitts are also described. Circle No. 1 for your copy.

EFFECTIVE CONTROL of dust in metal and non-metallic mines is described in a new brochure published by The Johnson-March Corp. The bulletin specifically describes performance and advantages of a system known as Chem-Jet which suppresses dust at its source. Circle No. 2 for your copy.

OSCILLATING CONVEYOR: the newest design in oscillating conveyors—Coilmount—is Link-Belt's most recent addition to its oscillating conveyor line for bulk materials handling. For your information Link-Belt Company has published a complete guide to the correct selection and application of stock size Coilmount conveyors. Circle No. 3 for a copy.

WELDING MACHINE CATALOG: Air Reduction Pacific Company have recently published a new catalog describing their complete line of arc welding machines and accessories. Specifications for each machine, from ampere ratings to outside dimensions, are included. Circle No. 4 for your catalog.

AIR COMPRESSORS: The Kellogg Division of American Brake Shoe Company has published a new 20-page catalog covering its line of 1/3 to 20 hp air compressors for automotive and industrial use. The booklet gives complete specifications on single and two-stage models, portable models, tanks, pumps and accesories. Useful compressed air charts, data, and other information are also included. Circle No. 5 for your copy.

CABLE TOOL CATALOG: Cable tool data and drilling bit catalog is available for you from the Spang and Company. According to the company Spang bits give increased footage, lower costs and fewer failures. Bits are die forged, completely heat treated, and have semi-dressed ends. Circle No. 6 for your copy.

BUELL CYCLONES: Dust collection efficiency goes up due to proper proportioning and side entry of dust laden gases in Buell cyclones. Large diameter design eliminates binding and clogging, keeping efficiency high under varying loads. For specific data Circle No. 7.

LAINYL filter cloth from Belgium is now available for your filtering equipment. According to company tests life of cloth is from six to ten times longer than other similar cloths, also filtrate production is greatly increased, cake-washing losses and blinding were decreased. Cloth can be supplied without seams to 24 feet. Circle No. 8 for the full story.

RUGGED AND LIGHTWEIGHT describes the new Hichcock Wonder Drill. The diamond core drill can drill over 100 feet, either vertical or at an angle. Gasoline powered, it takes only minutes to set up, and weighs less than 200 pounds. Can be simply taken apart to fit in your station wagon or pickup. Circle No. 9 for further information.

INDUSTRIAL LOCOMOTIVES: Case histories of different types of General Electric industrial locomotives are contained in a 24-page booklet now available from the company. The operating conditions and performances of 14 switcher-type and mining locomotives are outlined in the illustrated booklet. Circle No. 10 for your copy.

MAINTZ, manufactured by the West Chester Chemical Company, is a new coating which provides excellent protection against severe chemical and weather exposure, is particularly suited for protection of both buildings and equipment in processing plants, smelters, and other locations where severe conditions present problems in maintaining a protective coating. Maintz produces a coating which is exceptionally tough and long lasting, and does not dry to a hard and brittle finish, but forms a tough, resilient coating with exceptional resistance to abrasion weathering, and chemical corrosion. Due to sufficient elasticity, extremes in expansion and contraction may be accommodated. Circle No. 11.

2 IN 1 HAMMER TYPE ROCK CRUSHERS are now available from the Gruendler Crusher and Pulverizer Company. The 2 In 1 crusher can be used as a primary, secondary, or pulverizer type crusher. Using the swing hammer principle of reduction, the unit permits meeting practically any specifications with large reduction in one operation. For a copy of free catalog describing these units, circle No. 12.

RUST PREVENTION CATALOG: Available now is the new Rust-Oleum 1957 Coatings Manual, which actually is a treatise highlighting the stopping and preventing of rust on nearly all types of rustable metal throughout industry. This comprehensive, full color, 32-page manual provides a practical, workable guide for all buyers and users of protective coatings. Circle No. 13 for a copy.

NEW CORE DRILL: A new bulletin covering Sprague and Henwood's field tested Model 30 Core Drilling Machine is now available for you. According to the company, the Model 30 is a compact, lightweight, extremely versatile drilling machine designed for drilling in any formation under the most difficult conditions. Circle No. 14 for your copy.

FLEXIBLE COUPLING CATALOG: Torsionally flexible, Morflex couplings are fully described in a new 24-page catalog, recently published by the Morse Chain Company. The Morflex principle, employing preloaded rubber biscuits as the flexible medium, is explained and illustrated. Circle No. 15 for your copy.

WEATHER PROTECTED MOTOR: A new weather-protected motor for non-hazardous outdoor installations has been announced by Allis-Chalmers Manufacturing Company. Available in ratings of 250 hp and larger, the new motor is built into a rigidly constructed fabricated steel frame, equipped with two removable air ducts. Circle No. 16 for further information.

OPERATOR'S MANUAL: Just released by the Caterpillar Tractor Company is the new Traxcavator Operator's Guide. The new guide presents basic information on the operation of Traxcavators and the jobs they can do. This illustrated, four color booklet describes in simple terms the way to get the most work out of a Traxcavator with the least amount of effort. Circle No. 17 for your copy.

TRACTOR LITERATURE: Three new pieces of literature are available from the Construction Machinery Division, Allis-Chalmers Manufacturing Co. Usage information of the HD-11G and the HD-6G Diesel powered crawler tractor shovels highlights two of the brochures. The third brochure features the four pull-type

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to get further information on any item described in the Production Equipment Preview, note the key number of that item, circle the corresponding number on the PEP card at the right, and mail. If mailed from a point outside the United States, proper postage must be used.

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scrapers in the A-C line. Circle No. 18 for your copies.

ESCO 12 M High Impact and Abrasion-Resistant Steel is described in a recently released brochure. Typical uses for this steel are for points, scraper blades, chain, grouser tips, bucket parts, gears, end bits, and rippers. 12M alloy steel castings may be used wherever your equipment encounters severe abrasion and shock. Circle No. 19 for your copy of brochure.

BAGAC LOADING RODS: Now available from the Mahogany Importing Company are Bagac (Philippine Mahogany) loading rods. The rods, made up of this economical hardwood, are extremely long wearing, do not warp or splinter, are exceptionally strong, and come in long straight lengths from 8 feet to 20 feet, and in diameters from ¾ inches to 1½ inches. Large stocks of this hard, moisture resistant wood are also available for shaft guides, shaft sets, and chutes. Circle No. 20 for additional information and brochure.

UNDERGROUND SCOOP SHOVEL: The Thew Shovel Co. now has available a new catalog containing operating data and specifications of the Lorain-25 Scoop Shovel. Capable of work with low headroom, production of the shovel with a 1¼-yard bucket is high. Same shovel may also be used on surface with conventional ¾-yard shipper shaft shovel front end. Circle No. 21 for further information.

CYLINDER CAPACITIES: The Ledeen Manufacturing Co. has now available a cylinder capacity chart, which will help you determine the size of pneumatic cylinder needed to meet your particular application. Ledeen has cylinders available in diameter sizes from 1½ inches to 12 inches, and special cylinders are available up to 20 inches in diameter. Circle No. 22.

SAUERMAN METHOD: Learn about the Sauerman method of moving muck with their drag scraper machines. The company has available for you a catalog containing 24 pages of job photos and specifications. Field reports are also available showing material being handled by the low cost Sauerman method. Circle No. 23.

MILLER SWIVELS, manufactured by General Machine and Welding Works, provide maximum safety, plus faster hoisting due to non-spinning loads, faster load placement due to easy load turning, faster rigging, and elimination of twist and kinks which of course means longer rope life. Circle No. 24 for additional information.

ROTARY ROCK BITS: The H. C. Smith Oil Tool Company have a catalog available for you, showing prices and describing the complete line of Rotary Rock Bits. Bits with triple-bearing cutters, for long true running, are available for hard, medium-hard, and medium-soft formations. Circle No. 25 for your catalog.

NEW MAGNETIC SEPARATOR: Highly efficient recovery of magnetic media in heavy media separation plants is a feature of the Stearns Type "WPD" Magnetic Drum Separator. Designed especially for recovery of magnetite or ferrosilicon media in ore processing plants, the new Model "M" separator produces a magnetic concentrate of high specific gravity, even from non-densified slurry feeds. Circle No. 26 for more information.

TWIN-POWER SCRAPER: General Motors Overseas Operations in New York has announced the availability of a new Euclid Twin-Power scraper for worldwide distribution. With overhung engine design, the new Model TS-18 Euclid has a struck capacity of 18 cubic yards, and utilizes separate Allison Torqmatic Drives for each of its two engines. Circle No. 27 for further information.

NEW SUMP PUMP: A new air operated sump pump has been placed on the mining market by the Le Roi Division, Westinghouse Air Brake Co. The pump is rated at 340 gpm against a 10-foot head. Available in either steel or bronze, the pump, operating with a maximum head of 95 feet, features light weight construction, low air consumption, and a built-in lubrication system. Circle No. 30 for further information.

CONCRETE SPRAY GUN: The Blastcrete Gun, manufactured by Blastcrete Equipment Co., is now available for use in the mining industry. Handling high moisture content material, the Blastcrete Gun places one to eight cubic yards per hour, or approximately two yards per hour per 100 cfm of air. Circle No. 31 for further information.

STOP FRONT END DRAG with Warn Selective Drive Hubs. The Warn Manufacturing Company has available for you Selective Drive Hubs for your four wheel drive vehicle, which stop front end drag, thus decreasing gas consumption considably, and increasing the life of front end gears. Circle No. 32 for literature and further information.

ALLOY NOTEBOOK: The Electric Steel Foundry Corporation, Portland, Oregon, have available a technical engineering notebook describing .03 maximum carbon stainless castings. Esco developed this alloy to minimize the corrosion adjacent to welds under severely corrosive conditions and to eliminate as nearly as possible the need for a complete anneal after welding. Circle No. 33 for your copy.

DUROLITE SHEAVES: Durolite Blocks are now available for any job or machine requiring a quality block. These blocks are used on all Sauerman DragScraper Machines and Cableways for easier handling and to reduce wear on the running ropes. Durolite Sheaves are light in weight, but provide high structural strength and durability for handling heavy loads at high speeds. Circle No. 36 for additional information.

NEW CRAWLER LOADER: A new Crawler-Loader 30 hp engine, and ⅝ cubic yard struck, or ⅞ cubic yard heaped bucket is announced by John Deere. The rear-mounted, hydraulically controlled, three- or five-tooth scrafier is available as optional equipment. The Crawler-Loader is constructed so that a backhoe may be mounted also. Circle No. 45 for further information.

NEW DISC FILTER: Denver Equipment Company's new nine-foot diameter Disc Filter has 105 square feet in the filter area per disc. There are 12 segments per disc instead of the usual 10, giving greater filter capacity because more complete segments are under vacuum each revolution. Circle No. 46 for complete information.

GROSS WEIGHER: A new automatic gross weigher that offers accurate, push-button weighing of difficult adhesive materials is described and illustrated in a new 6-page, 2-color bulletin now offered by Richardson Scale Company. Circle No. 47 for your copy.

SAFE HANDLING OF H_2SO_4: Up-to-date instructions for the safe unloading and handling of sulphuric acid are presented in easy-to-read form on a new 17 by 22-inch wall chart available from the Industrial Chemicals Division of the Olin Mathieson Chemical Corporation. Circle No. 48 for a copy.

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Turbo-Charged Tractor Dozers By Michigan

Two new rubber-mounted tractor dozers for high speed operation have been announced by the Clark Equipment Construction Equipment Division. The new machines have a top of 28 mph in either direction. The Model 280, a 42,000 pound vehicle has a 11'9" blade and the Model 380 has a vehicle weight of 62,000 pounds and has a 13'3" blade.

Hydraulic controls provide positive down-pressure for heavy going and the blades can be tilted for work under special conditions by means of a double-acting tilt cylinder. Rear wheel power steering permits turns while dozing with no loss of power or load, according to the manufacturer. Turbo-charged Cummins diesels are used in the power plant of the machines. For further information circle No. 69.

New 6-Yard Tractor Shovel For High Speed Loading

A new 6-cubic yard capacity "Michigan" tractor shovel has been developed by Clark Equipment Construction Machinery Division to provide low-cost high speed loading, stockpiling or materials handling. The machine is powered with a Cummins 375-hp diesel and has a gross weight of more than 50,000 pounds. It will lift 30,000 pounds while stationary and will carry 15,000 pounds at 4 mph according to the company. The machine uses rear-wheel steering for better maneuverability, and for maximum safety and control there are air-brakes on all four wheels. Four-speed power shift with two fingertip control levers is standard equipment. For details circle No. 70.

New Drill Crawler Announced by Thor

A new rock drilling crawler designed to reduce drilling time as much as 30 per cent has been announced by Thor Power Tool Company. The new rig, designated the M-2 "Drillcat," is entirely self-propelled with drill, mast, and air power mounted for one-man operation. The air-operated crawlers enable the rig to move over rough terrain and eliminate the need for labor crews to reposition drill. Consisting of a Thor 105M Drifter, and the BW-2 Wagon Drill Mast mounted on crawlers, the unit is equipped with twin, reversible 7½ hp air motors. A hydraulic boom raises or lowers the drilling mast. The 3,000 pound crawler's motors have sufficient extra power to also tug compressors into drilling position. Circle No. 76 for additional information.

Detection Instrument Simplifies Prospecting

Electro-Technical Labs, Houston, Texas, have developed a new radiation detection instrument, called the RL-1, which produces a permanent record of radioactivity in shot holes, core holes, or surface outcrops. The new instrument may be powered by either an "A" battery, or by plugging into automobile cigar lighter.

Instrument components consist of a high-quality geiger counter, graphic recorder utilizing ball-point pen writing, a cable and chart drive which insures uniform logging speed and absence of slippage, 250 feet of 320-pound breaking strength cable, a rugged hole probe with a counter tube of permanent sensitivity and unlimited life. For additional information on this versatile instrument, circle No. 77.

Side Dump Loader For Greater Flexibility

A new side dumping bucket attachment for Caterpillars Traxcavator has been announced.

This machine, popular among many mining operators, will provide for still greater use of the machine with less turning and maneuvering. Made for "in-line" loading the side dump feature is a natural for the many restricted areas in mining operations.

This new feature can be used or not, depending on the need, and is firmly locked when the bucket is in digging position. When side dumping is desired the operator simply actuates a hydraulic cylinder by means of a control lever. When in operation the dumping cylinder unlocks the bucket and swings it to a side dumping angle of 60 degrees. For information circle No. 72.

Notes From The Manufacturers

Robert Marr & Son, Inc., 154 Nassau Street, New York City, has been appointed by the Resisto-Loy Company, Inc., Grand Rapids, Michigan, as exclusive representative and distributor for South America, Europe, Africa, and Asia. The Resisto-Loy Company manufacturers a complete line of hard-facing alloys, used for repair, rebuilding, and wear-prevention on heavy-duty equipment.

Ronald Whiton has been named sales engineer for the Goodman Manufacturing Company, Chicago. Mr. Whiton, a graduate of the Michigan College of Mining and Technology and with experience at properties of Calumet and Hecla, will represent the company in upper Michigan, Minnesota, and parts of Canada. Goodman also made several promotions in the Mancha Storage Battery Locomotive division. New general manager, replacing C. E. Stoltz retired, is J. A. Appleton, and new chief engineer is R. M. Ansel. Mr. Appleton retains his duties as manager of sales.

Robert G. LeTourneau, president of R. G. LeTourneau, Inc., recently announced that his firm will re-enter the earthmoving industry in 1958 after a five-year absence. According to LeTourneau, the machines he will introduce in 1958 will have the ultimate in traction and mobility, will be driven by "Electric Wheels," and will be powered by Diesel-electric dynamos similar in principal to those on modern Diesel locomotives. Equipment will be marketed under trademark "AR-GEE."

Howard L. Phillips has been advanced to the position of export sales manager and Donald R. Johnson to assistant export sales manager of the Nordberg Manufacturing Company, Milwaukee. Mr. Phillips was formerly assistant export manager and Mr. Johnson, senior sales engineer of the export division.

The Caterpillar Tractor Company will build a 500,000-square-foot industrial engine plant 12 miles north of Peoria, Illinois. The company also plans to construct a multi-building research center and a general office building. Operations in the new area will begin during 1958 and 1959.

Hycon Aerial Surveys, Inc., Pasadena, California, has established a new scientific advisory board consisting of Charles L. Miller, Massachusetts Institute of Technology; Francis H. Moffit, University of California; Robert S. Brandt, chief of the Photogrammetric division, and Kenneth E. Hunter, chief of the Geophysics division of Hycon. The company also announced that Paul Van Wert, a pilot for 26 years, has been named flight operations manager. He will be in charge of the world-wide flight operations of all aerial surveys' crews.

Pickard Industries, Inc., of Mt. Vernon, Illinois, was recently organized to take over the operations of the Central Mine Supply Company and the Tamping Bag Company.

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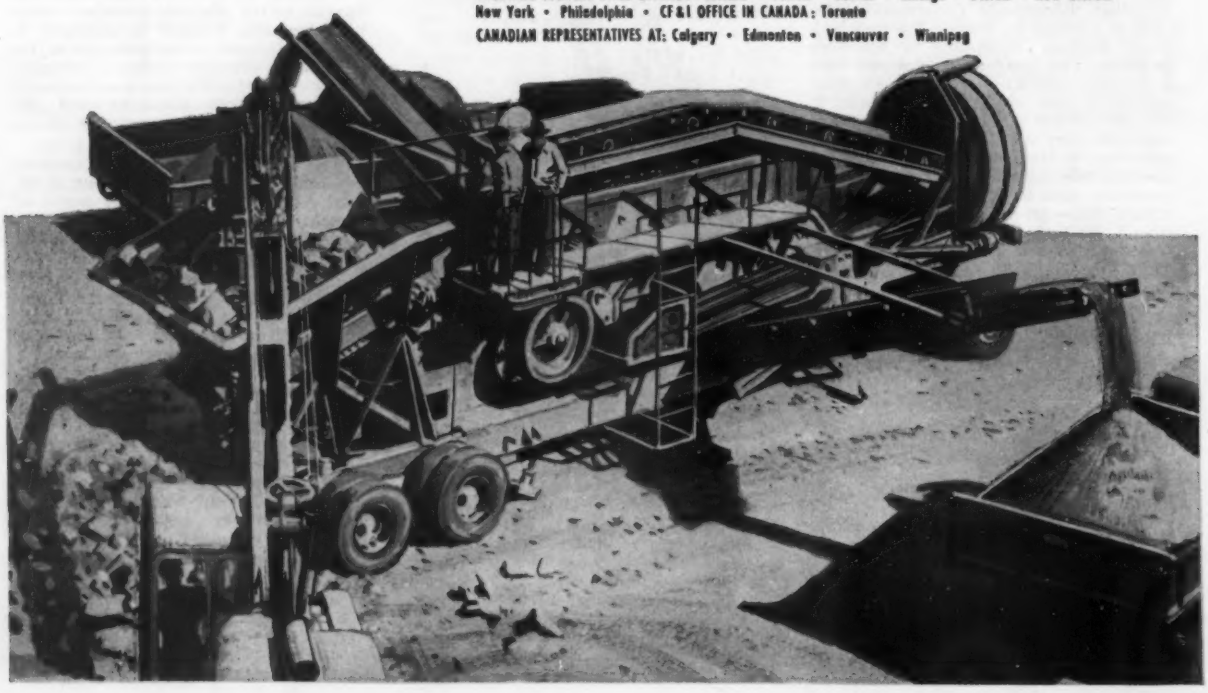


Attempts By India To Absorb Portuguese Goa Spur Goan Miners On To Greater Production

Goa, a small Portuguese province situated on the western coast of India, with a population of only 600,000 occupying its 1,469 square miles, has been front page news in recent years because of the Indian Union's ambition to absorb it. This advance was strongly repulsed by both Portugal and the Goans themselves, who had no desire to integrate.

Diplomatic relations between Portugal and the Indian Union were severed, traffic and trade stopped, thousands of Indian "satyagrahis" marched against Goa, and finally a boycott was imposed on those steamers that stopped at Bombay before or after calling at the port of Marmagoa.

The repatriation of thousands of Indian laborers seriously affected the production in the Goan mines temporarily, but it also gave incentive to the people. Local laborers, who had been satisfied to work in the rice fields from four to six months of the year, decided to fight the crisis and responded to the call for mine workers.

This was the dramatic beginning of the rise of Goan mineral exports. The figures for 1952 practically doubled in 1953, the year Indian pressure was at its highest. For the first time in the mining history of Goa, the export figure for iron ore passed the 1,000,000-ton mark in 1954.

There are 507 mines in the territory and about 85 of these are in production. At some mines the ore is dug from the surface with ordinary pick-axes where the rock formation permits. Primitive methods are still in use at some mines which belong to miners of very modest means, who sell their ore to the exporter at the pits. (Two years ago it was possible to stake a claim and own a mine for about $1,200.) Production in such cases is rarely over 100 tons a day. Most of the mine owners, however, have acquired some modern drilling equipment; they also use local blasting powder and imported high explosives. They manage to produce from 500 to 1,000 tons of ore daily.

There is only one fully mechanized mine in Goa, owned by Messrs. Chowgule & Company who spent $3,000,000 on equipment and installations. It has been in operation since October 1953 and production is expected eventually to reach 2,000,000 tons of iron ore per season.

The demand for Goan ore far exceeds the supply. There are no blast furnaces in the country, so the entire production is exported. The greatest advantage of mining in Goa is the proximity of the mines to rivers and railroad. Trucks carry ore from the pits to these points, whichever is nearer, and from there it is transported to the harbor. The river transport is comprised of LCT's, barges, and native crafts which carry between 20 to 200 tons each per trip. Owing to the limited number of berths at the harbor, most of the transfer loading is done in mid-stream. More than 150 ships have been loaded and dispatched annually since 1953.

Iron ore exports have risen from 49,188 tons in 1949 to 1,505,314 tons in 1955, and 910,091 tons for the first six months of 1956. Grade varies between 50 and 60 percent iron. Manganese ore was first exported in 1947 (100 tons) and shipments rose to 207,361 tons in 1953. Although the grade of 38 to 48 percent manganese justified a continued greater output, the price drop in 1954 affected production and the exports for 1954 decreased to 101,796 tons. The principal markets for iron ore exports were Japan and West Germany in 1954; the United States bought over half of the manganese production that year.

The mining season lasts eight months, from October to May. The heavy monsoon from June to September practically brings production to a standstill, and no steamers call for ore at Marmagoa during this period.

African Nickel, Manganese Interest Vanadium Corp.

African nickel and manganese claims have been acquired by Vanadium Corporation of American within recent months.

The manganese concession, to be known as the Chilili East Manganese Area, was acquired from British South Africa Company. The property covers about 2,460 square miles, and is located in Northern Rhodesia near the 200-square miles manganese concession purchased by Vanadium in September 1955. The present concession gives the company the exclusive right to prospect and stake claims for manganese.

The nickel claims are in Southern Rhodesia, about 10 miles north of Salisbury. Preliminary assays on samples have indicated promise of low-grade ore. Considerable research will be required to determine its value. The option gives Vanadium sufficient time to explore the property before deciding whether to develop it.

Some Uranium Contracts Extended By Canada

Canadian uranium producers unable to obtain complete write-off of pre-production and capital expenses by March 31, 1962, will receive special price contracts from the government allowing for a year's extension and increased quantity. The announcement was made by Eldorado Mining & Refining, Ltd., a government corporation.

The original special price contracts, set to end in March 1962, provided for amortization of pre-production and capital expenditures, as approved by Eldorado, over five years production at full-rated mill capacity. However, some producers, due to certain unavoidable delays, will be unable to meet the deadline and have been granted the special extension on their price contracts.

Japanese Geologists Find Eight U_3O_8-Bearing Veins

Japanese government geologists have discovered eight uranium-bearing veins in central Honshu, Japan's main island, in recent months.

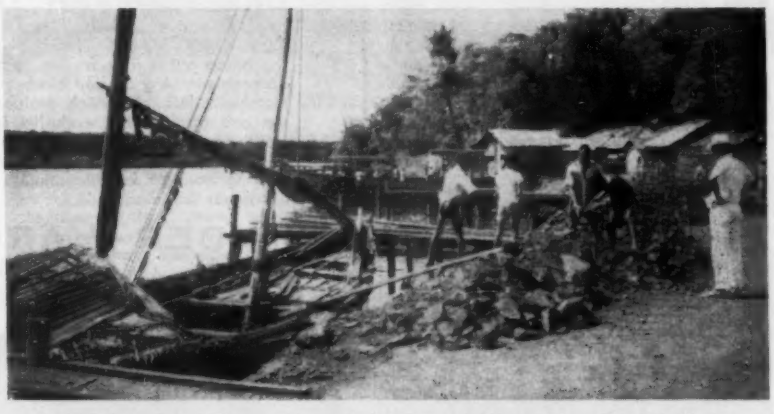
These discoveries along the border between Okayama and Tottori prefectures are the most important yet made in Japan. The mineralized area near the Kokamo mine was discovered by geologists of the MITI's Atomic Fuel Corporation, and the Geological Research Institute.

Geological studies and exploration of the veins are planned.

ITALY—*The Montecatini Company* is planning to erect a new plant at Crotone, in southern Italy, to produce 12,000 tons of aluminum annually. The company may also increase the capacity of its Bolzano aluminum plant to 4,000 tons annually.

HUNGARY—The uranium mines near Pecs are under study by more than 100 Soviet experts, according to reports from Budapest. Samples of ore tested averaged 0.7 percent uranium, with the richest at about 3.0 percent. An Hungarian scientist, who fled the country recently, estimated that 65 tons of ore had been shipped from the area before the uprising; current reports say that 25 tons or ore are being mined there daily. Pre-revolt agreements provided for a joint Hungarian-Soviet company, with Russia paying Hungary the operational costs plus 10 percent.

WEST GERMANY—A study group consisting of *Krupp*, *Hosch*, and *Oberhausen* has been set up to prepare joint long-term contracting for iron ore. The *Kloeckner Company* recently signed an agreement with the *Aconic Company*, of Canada, to receive 3,750,000 tons. Only



Loading iron ore on 20-ton native craft for transportation to ship anchored in harbor.

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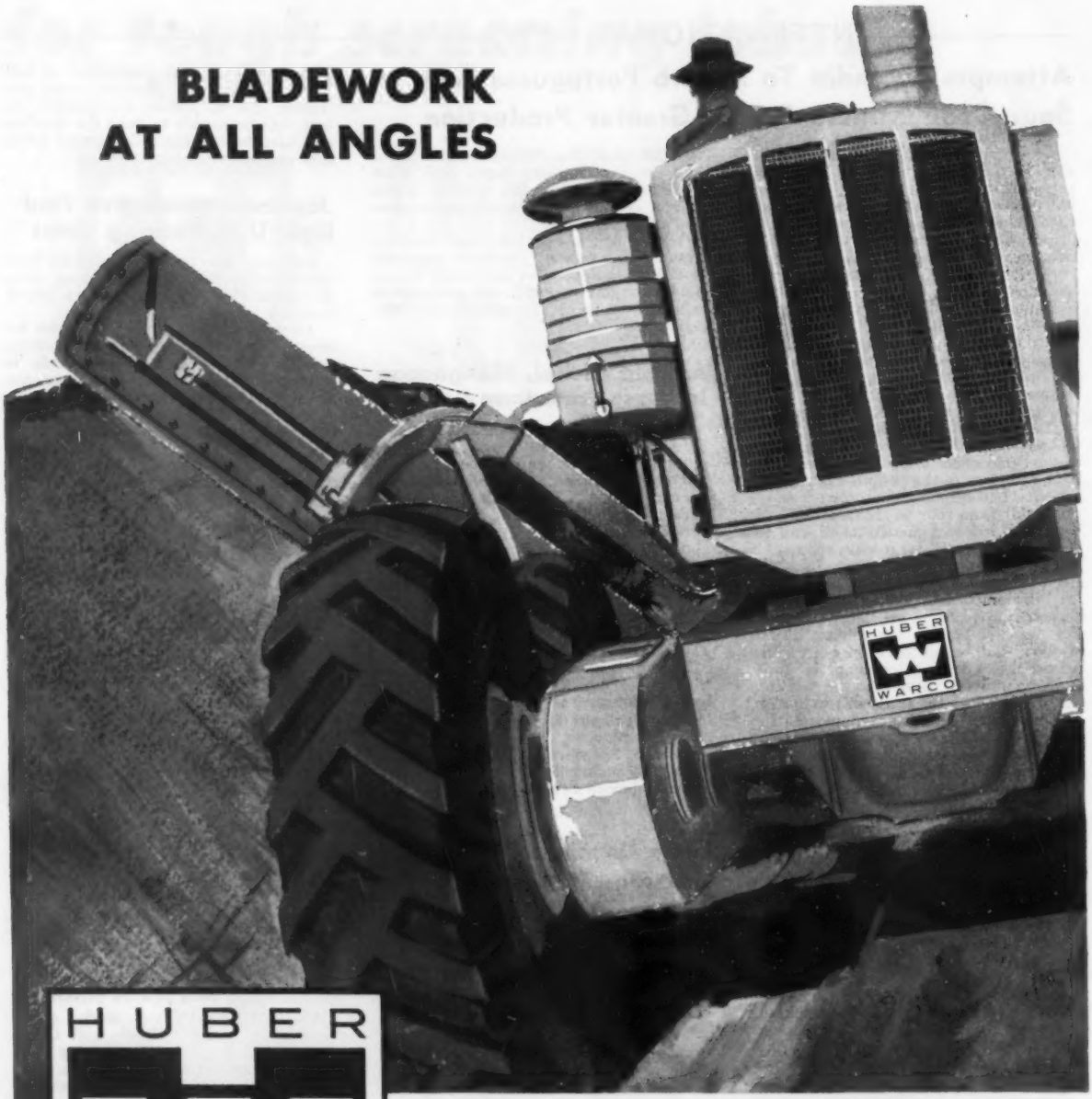

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25 percent of Germany's iron ore requirements is domestically mined; 30 to 35 percent of the ore needed comes from Sweden and the remainder from Venezuela, Liberia, and Canada. To provide shipping facilities, ore carriers are being built by some of the large Ruhr combines.

FRANCE—Bauxite production for the first half of 1956 was 702,000 tons. Output for the same period of 1955 was 788,000 tons.

NORWAY—The old *Kongsberg* silver mine has been closed after more than three centuries of mining. The mine has produced about 1,300 tons of pure silver since it was chartered in 1624. In 1951 the Norwegian government made geological and cost studies in the hopes of reviving activity for the company, which had operated at a lost for several years.

RUMANIA—The Soviet Union has transferred to Rumania its 50 percent ownership of the joint Soviet-Rumanian company, *Sovromquartz*, which operates Rumania's uranium deposits. This company was founded in secrecy several years ago when uranium was first discovered in Rumania. In 1954 the Soviet Union transferred to Rumania its share in 12 other joint enterprises, but at that time retained its interest in Sovromquartz.

SCOTLAND—Operations at the Barbary fluorspar mine of the *Weardale Lead Company, Ltd.* are progressing successfully on the 204 foot-level. The Stotsfieldburn fluorspar mine is also under development. The ore was found to contain fine grained silica on the 300 foot-level, eliminating the possibility of gravity treatment methods.

WEST GERMANY—*Phoenix-Rheinrohr AG*, of Duesseldorf, has installed a $7,500,000 blast furnace at its Ruhrort plant. This addition increases the capacity of company by 30,000 tons of crude iron per month and makees it the largest crude iron manufacturer in West Germany, with an average monthly production of more than 200,000 metric tons.

RUSSIA—A deposit containing several million tons of iron ore is now being developed near Karanganda, along the river Atasou.

FINLAND—Vanadium is being extracted from the titaniferous magnetite of the *Otanmaki* iron mine at a new plant opened last August. The output will be about 300 tons of vanadium for the first year of production, which is equal to about six percent of world consumption. Capacity will be doubled during the second year. The major part of the output will be exported to Sweden, West Germany, and France. See MINING WORLD, August 1956, pp 62-68 for a complete report on Otanmaki's mining operations.

NETHERLANDS—Fabrication of fuel elements for a "swimming pool" type of nuclear reactor will be handled by the United States firm, *Babcock & Wilcox Company*, for the Netherlands Ministry of Education. These fuel elements will be the first provided by American private industry for use abroad within the framework of the "Atoms for Peace" program. Under this program a 20 percent enrichment is the maximum which can be used for foreign research reactors. The Babcock & Wilcox fuel elements will be the first 20 percent enriched uranium-aluminum alloy type to be put in use. The reactor will be used by the universities of The Netherlands for research and training, and will be shown at the international exhibition "The Atom", opening in Amsterdam June 23, 1957. It was designed and built by *AMF Atomics, Inc.*, subsidiary of *American Machine & Foundry Company*, which also acted as consultants in the purchase of fuel elements.

RUSSIA—Soil and plant mineral content are tested in a new ore prospecting method which was developed by Soviet Academicians Vernadsky and Vinogradov and is now being applied in Russia. Grass growing over nickel deposits in the Southern Urals was tested and found to have a 0.06 percent nickel content, while under normal conditions the nickel content of grass amounted to 0.001 percent. A similar test was made in the Karadjian district of Armenia and a molybdenum content of 0.05 percent was found. Molybdenite deposits were later discovered in the same area. This prospecting method is said to be applicable to nickel, cobalt, uranium, zinc, molybdenum, and lead.

YUGOSLAVIA—A lead and zinc mine at Kiznica, containing more than 5,000,000 tons of ore, will start production about the middle of 1958. The mine is 30 miles from Yugoslavia's richest lead and zinc mine at Trepca which once was owned by a British concern. The *Kiznica* mine will initially produce 150,000 tons of ore per year. In 1961, when the second construction phase is completed, production will surpass 500,000 tons a year. This is equivalent to the present *Trepca* mine capacity.

GREECE—The manganese mines at Styra-Euboea will have an annual output of between 10,000 and 15,000 tons of ore, worth $400,000 to $500,000, when they are equipped to start production. The Greek government has approved the import of $108,000 worth of equipment by *Brussels Mining Enterprise Company*, the Belgian firm that will develop the mines. Approval was also granted for an import of $100,000 worth of equipment for development of the manganese mine at Kafkaki-Tyrnavos by a Norwegian company. Output from this mine will be about 12,000 tons a year, chiefly for export.

ITALY—A 134,000-kilowatt atomic power plant will be purchased by *Edisonvolta, S.p.A.*, an Italian power company in Milan, from *Westinghouse Electric International Company*. The plant will be very similar to the pressurized water reactor being built for the *Yankee Atomic Electric Company* at Rowe, Massachusetts and will be in operation soon after the American plant.

SPAIN—*Altos Hornos de Cataluna S.A.* will install two new 18-ton electric steel furnaces and other equipment, at a cost of 38,000,000 pesetas, at the company's steel plant at Hospitalet, Barcelona.

RUSSIA—The Soviet Ministry of Geology has estimated the diamond reserves in the Yakutch Autonomous Soviet Socialist Republic to amount to several hundred million carats. The Ministry has established a base for prospecting at Nyurba, on the banks of a tributary of the River Lena, and expects to discover deposits enough to change Russia's status on the world diamond market from importer to exporter.

Bunker Hill Recruits Hungarian Refugees

Pictured above are the Hungarian refugees (with two of the wives) recently recruited at the Camp Kilmer, New Jersey refugee camp for employment at Bunker Hill Company's Kellogg, Idaho mining operations. One of Hungary's leading design engineers was among the 18 hired by the Bunker Hill to help carry out its recently announced $15,000,000 expansion program in the Coeur d'Alene mining region. He is Lajos Sikos-Tomay, 37, reputed to have been chief design engineer for a large Hungarian aluminum plant, an iron smelter, and several mills. Other technically trained escapees hired by the company include: Laszlo Makk, 35, a mechanical engineering graduate with 12 years' experience in design work and Hungary's fifth-ranked tennis player; Charles Komar, 27, mechanical engineering graduate with four years' design experience; Vilmos Nemeth, 26, civil engineer graduate with three years' experience; Miklos Nyergesi, 27, geodetic engineer; and Antol Mayer, 28, forestry graduate with experience in mechanical engineering. Among the refugee mine workers hired, one was reported to have participated in dynamiting of the Pecs uranium mines during the Hungarian revolt against Red rule. Bunker Hill, only mining company to engage in the stiff recruiting competition against the nation's largest industrial concerns, looked in vain for chemists and metallurgists among the refugee group at Camp Kilmer.

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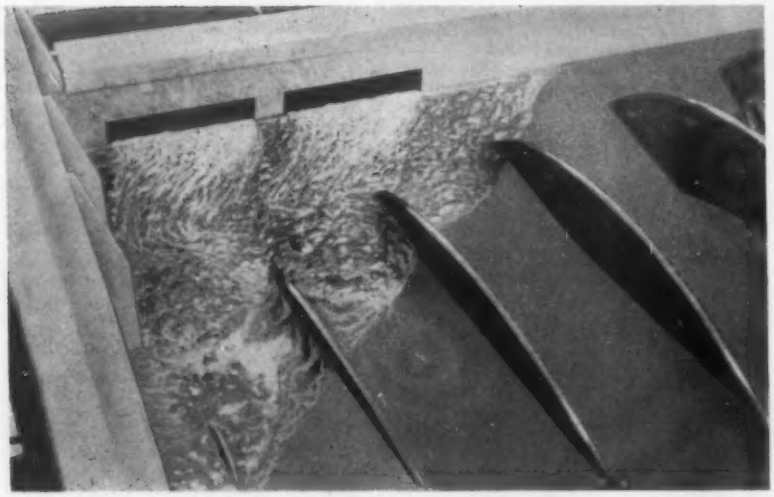

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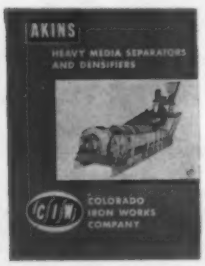

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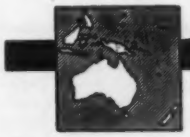

QUEENSLAND—*Broken Hill Proprietary Company Ltd.*, iron and steel producer, will undertake a large-scale prospecting program for iron ore in northern Queensland. The search will cover two areas totaling 6,300 square miles. A base is being established in the Constance Range on the Northern Territory border west of Mt. Isa. Land Rovers will be used to explore 4,500 square miles of country in this area but helicopters may be used for rugged country covered with rain forest. In the Iron Range area, eastern Cape York, all minerals will be sought in an area of 1,800 square miles. A base will be established in the Temple Bay area.

REPUBLIC OF THE PHILIPPINES—*Republic Resources and Development Corporation* is undertaking extensive development of 65 mining claims in Apayao, Mountain Province. Diamond drilling equipment has been ordered from the United States. Copper, gold, silver, lead, and molybdenum mineralization have been confirmed. The corporation is also engaged in geological work for various other firms acting as consultants and researchers.

NEW CALEDONIA—Herman Mollet of Noumea reports he has uncovered a tungsten-molybdenum deposit near the port of Noumea. An analysis of the ore has shown scheelite at 1.1 percent and molybdenite at 1.3 percent.

NEW SOUTH WALES—*Mines Exploration Pty. Ltd.*, as subsidiary of *Broken Hill South Ltd.*, will transfer its rights in the area around Cobar, recently acquired from *New Occidental Gold Mines N.L.*, to two new companies. One firm will be called *Cobar Mines Pty. Ltd.*, with a nominal capital of £1,000,000. It will take over and operate the copper leases comprising *Great Cobar, Cobar Gold*, and *Chesney* leases. The other firm, to be called *Cobar South Ltd.*, will take over what are considered to be the gold leases—*New Occidental* and adjacent areas. These moves are necessitated by taxation matters. It is believed that the first company may produce at a future rate of 15,000 tons of copper per year.

REPUBLIC OF THE PHILIPPINES—*Northern Mining and Development Company* has started mining operations on its properties at Calaburnay, Paracale, Camarines Norte.

WESTERN AUSTRALIA—*Hill 50 Gold Mines N.L.* made the largest gold mining profit in Australia in 1956—£903,436. The mill treated 118,622 tons of ore for a recovery of 83,295 fine ounces of gold worth £1,302,091. Ore reserves are stated at 833,000 tons assaying 13 dwts. Drilling of a southerly shoot on the 1,304-foot level shows that it is much longer at that level than expected. The treatment plant is being enlarged and extra equipment is being installed in the power house.

REPUBLIC OF THE PHILIPPINES—*Hixbar Gold Mining Company* will sell all unsubscribed capital stock at Pesos 0.12 per share to stockholders on record as of January 15 in order to obtain additional capital for completion of its flotation mill on Rapu Rapu Island. The *Hixbar* copper and iron sulphide mine on

Rapu Rapu has been under rehabilitation since the end of World War II. The mill will facilitate production of both iron sulphide concentrates needed in manufacture of fertilizer, and copper concentrates.

QUEENSLAND—*Mary Kathleen Uranium Ltd.* will build a large sulphuric acid plant in the Mt. Isa-Cloncurry district. Work on the main units has already been started by *Simon-Carves Ltd.*

NEW SOUTH WALES— The *Electrolytic Refining and Smelting Company Pty. Ltd.* will modernize its smelter at Port Kembla through the addition of an updraught Dwight-Lloyd sintering machine. This is necessitated by increasing offers of copper concentrates for custom smelting, particularly by producers in the Northern Territory. The sintering plant will collect a portion of the sulphur dioxide gas which, after cleaning, will be utilized for the manufacture of sulphuric acid.

NORTHERN TERRITORY—The wet season has hampered some development by the uranium ore producers but the greater part of the pitchblende shipment by *United Uranium N.L.* is now complete. The *El Sharana* mine and *Saddle Ridge* prospect continued to give encouraging results. At *Rockhole* prospect, not far away, *South Alligator Uranium N.L.* is obtaining excellent results also. From 10 to 58 feet below the floor of No. 2 adit, an average of 2.6 percent uranium oxide has been determined over 38 inches in width. *North Uranium Uranium Corporation N.L.* recently stated that its Milestone area is undoubtedly a large, low-grade deposit with patches of high-grade material throughout the body.

REPUBLIC OF THE PHILIPPINES—Development work by *Palawan Quicksilver Mines, Inc.* on Palawan Island has been very satisfactory. Extensive benching in four sections is reported to have exposed ore of above average grade. Over 2,000 feet of new bench has been excavated in the past few months. In the northern section of the property, diamond drilling is proceeding with encouraging results.

NEW SOUTH WALES—*North Broken Hill Ltd.* increased lead-zinc production by 11 percent in the six months ended December 3, 1956. Ore treated was 214,158 tons assaying 12.9 percent lead, 7.1 ounces silver, and 11.1 percent zinc. This compares with 197,688 tons at 13 percent lead, 7 ounces silver, and 10.7 percent zinc in the same period of the previous year. Metal contents of the concentrates producers were: 26,729 tons lead, 1,388,523 ounces silver, and 20,851 tons zinc.

TASMANIA—*Tasmania United Uranium Company N. L.* has been formed to obtain mineral rights over an area near Rossarden known as *Chalezyk's Lease.* High-grade primary ore was reported in this area some months ago.

TERRITORY OF HAWAII—*Reynolds Metal Company* and *Kaiser Aluminum & Chemical Company* are said to be investigating extensive low-grade bauxite deposits in Hawaii. Reynolds is said to have requested the territorial government to auction off the mineral rights to extensive areas of public land.

REPUBLIC OF THE PHILIPPINES—*Elizalde and Company* has completed negotiations with five of Japan's leading steel mills to absorb the production of *Samar Mining Company.* Manuel Elizalde, president of the firm, upon his return from Tokyo revealed that the Japanese firms will underwrite and be responsible for all shipping facilities necessary to haul the ore from the mine piers to Japan. He expects development to be in full swing shortly in the vast *Sibuguey* iron mining property. The Japanese steel mills will also begin laying out a 40-kilometer railroad from the Sibuguey area to the company pier.

INDONESIA—Technical experts from the German consulting firm *Wedexro,* in cooperation with geologists of the Djawatan Geologi at Bandung, have completed an investigation of the titaniferous iron ores in the Djampangs in West Java, the contact-metamorphic deposits in the Lampongs of South Sumatra, the titaniferous deposits near Tjilatjap, central Java, and the lateritic iron ore deposits in the Kukusan Mountains, Pulau Sebuku, and Pleihari in southeast Borneo. Some ore was shipped to Germany for testing. Results should be known by April of this year.

VICTORIA—*Morning Star, N. L.* of Wood's Point has completed equipping of its new inclined shaft to the 24 level and is driving toward an expected richer gold-bearing zone of a recently discovered reef. Future of the mine depends upon favorable results in this area of operation. The state's current leading gold producer is *Wattle Gully Gold Mines N. L.* of Chewton which is also shaft sinking and developing. The gold industry in this state is slowly dying out.

REPUBLIC OF THE PHILIPPINES —*Palawan Consolidated Mining Company* made several shipments of high-grade metallurgical chromite to the United States before the end of 1956, and is now in a position to make regular shipments depending upon availability of shipping space. The company is also carrying on development work at two other properties. Its second chromite deposit is being prepared for mining and more ore is being developed on the *Sugod* quicksilver deposit.

NEW SOUTH WALES—*Broken Hill South Ltd.* has formed two companies for the investigatiin of the *Cobar* copper-gold field. The two firms are *Cobar South Ltd.* and *Cobar Mines Ltd.*

BURMA — The *Burma Corporation (1951),* a joint venture of the Burma government and the *Burma Mines Ltd.,* showed a net profit of $1,473,100 for the year ended June 30, 1956. The company operates a lead-zinc-silver mine at Bawdin in the Shan states, and is one of the world's great mines. The concentrating plant which originally treated 96,000 tons per annum is now being extended to treat 144,000 tons per annum. Diamond drilling is now in progress within the main Bawdin mine lease area of 10 square miles to prove the local geology beyond the limits of the proved ore bodies. Plans are also being considered for an aerial geophysical survey of a 550-square-mile area in which the company is interested.

MALAYA—A modern tin dressing plant is being designed to handle production from the No. 1 and No. 2 dredges of

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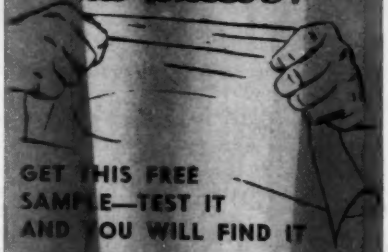

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Ayer Hitam Tin Dredging Ltd. The plant would also treat the Amang dumps from the present dressing plant. Options have been obtained on two adjoining mining leases and these will be drilled as soon as possible. Close drilling immediately south of the No. 1 dredge has yielded satisfactory results. Boring is also taking place on the east and west extensions of earlier drilling lines and payable values have been disclosed.

TURKEY—The *Uludag* scheelite deposits will be developed jointly by Turkish and West German interests under a recent agreement. The *Eti Bank* and *Krupp* of Germany have agreed to the formation of a Turkish-German company, and this agreement is subject to ratification by both governments. Krupp will supply equipment and machinery for the undertaking. The Eti Bank is already cooperating with *Lurgi*, another German firm, for the construction of a coking plant in Tuncelli which would process lignite deposits.

PAKISTAN—The *Pakistan Industrial Mining Syndicate* is setting up the country's first marble cutting mill. Scheduled to go into full production by the end of 1958, the plant will have an annual output of marble and marble blocks valued at Rupees 1 crore. Major part of the product will be exported to the western markets, particularly the United Kingdom and Italy. Marble quarries in the Chigai district of the Kalat Division will supply the mill. These deposits have been estimated at 10 lakh tons and are reportedly sufficient for a period of 30 years.

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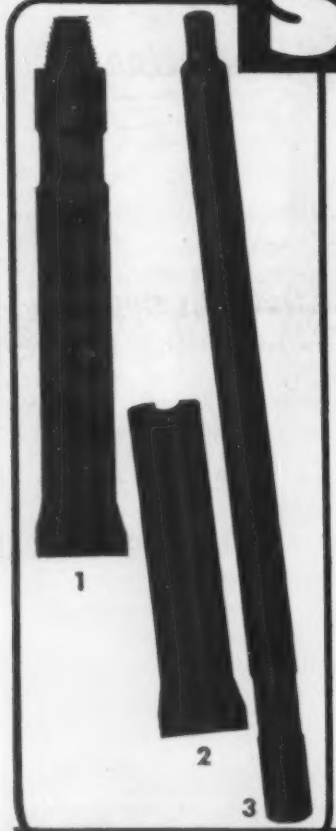

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For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.

KOREA—UNKRA will finance construction of a modern graphite mill at the *Sihung* graphite mine in the province of Kyonggi Do. The 200-ton mill will make possible a wider development of the crystalline graphite deposits at Sihung estimated at 20,000,000 tons. The company's present mill has a capacity of 800 tons of low-grade concentrates annually, with a gross value of $120,000 a year. Under the new UNKRA project, the existing mill will be capable of producing a higher grade product worth $160,000; the new mill will have a capacity of 2,400 tons worth $720,000 annually. Thus the total potential value will be increased seven times over that presently obtained.

MALAYA—Officials of *Malayan Tin Dredging Ltd.* have estimated that the cost of the new dredge, erected and ready for operation at the end of 1958 or early 1959, will be between £800,000 and £850,000. This machine is designed to handle 3,600,000 cubic yards of gravel a year. When treating ground of average recoverable value of Kampong Gajah reserves, 0.466 pound per cubic yard should produce 750 tons of tin concentrate. As of June 30, 1956, estimated reserves remaining in Kampong Gajah amounted to 368,000,000 cubic yards and this ground should provide the company with a life of 35 years. The question of installing another, the fourth, dredge is now being considered.

BURMA—*Tavoy Tin Dredging Corporation* is rehabilitating its dredge, workshop, and camp at the *Theindaw* property in the Mergui district, and expects to start dredging operations by July 1957. The company also expects to start dredging at its *Kyaukmedaung* property in the Tavoy district very shortly. A European dredge master is already residing at the camp.

TURKEY—After a short inspection by the *Newmont Mining Company* in the old mining district of the Black Sea coast, the *MTA Institute (Turkish Institute for Mineral Resources Development)* is now drilling and mapping some copper-pyrite deposits. Results cannot be expected for a few months.

THAILAND—The government will collect money from tin miners and export buyers for contribution to the International Tin Buffer Stock. Thailand agreed to contribute money instead of tin to the buffer stock. Levies will be at a rate of £2 per picul for tin-in-concentrate and £3 per picul for tin metal. The levy will be made on a minimum quantity of 320,000 piculs and a maximum of 620,000 piculs.

INDIA—The Minister for Heavy Industries reports that orders have been placed with the United Kingdom, Japan, West Germany, the Soviet Union, Czechoslovakia, Italy, China, and other countries for the supply of 60,000 tons of steel to India during 1957. According to provisional estimates. India might require about 3,000,000 to 3,500,000 tons of steel next year.

PAKISTAN—The site selected by the *Pakistan Industrial Development Corporation* for the country's first iron and steel plant near Multan has been found to be acceptable by foreign experts. Swedish and German technicians reportedly checked the site. Intensive survey and testing disclosed that it was suitable for heavy foundations, and was located close to a main road, the railway, the

central power grid system, and the Sui gas line. Plans are being drawn up for mining the iron ore at Kalabagh, and surveys are also being made of the Chitral area as another iron ore source. The government has asked the World Bank for a loan. The proposed plant is expected to cost about Rupees 17 crore.

THAILAND—The Thai government is reported to have signed an agreement with *Krupp* of Germany for a survey of the possibility of erecting a steel plant in the country. This follows a preliminary investigation made earlier by Krupp of iron and coal deposits in North Thailand. Upon completion of this new survey, the government is expected to contract with Krupp for the setting up of a joint undertaking to develop iron and coal resources of the country.

BURMA—*Thabawleik Tin Dredging Ltd.*, having dredged all of its tin-bearing ground at Thabawleik in the Mergui district, has advertised its dredge, mining plant, and equipment for sale. Cessation of the tin output from this company will considerably lower the tin exports from the Mergui district temporarily. In the first nine months of 1956, this district exported 60 tons of wolframite concentrate, 335 tons of tin concentrate, and 70.6 tons of mixed concentrates.

JAPAN—A zirconium company will be set up jointly by *Nippon Mining Company* and the *Ishizuka Research Laboratory* to produce zirconium. Eventually, the firm will go into the uranium and thorium fields. Monthly production capacity is to be 20 tons; name of the firm has not been announced.

TURKEY—A new Atomic Energy Law has been passed by the National Assembly of Turkey which will provide for the establishment of an atomic energy commission.

JAPAN—The *Gordon I Gould Company* of San Francisco, California is building a new 30-ton-per-day, oil-fired, Gould rotary furnace plant for the *Yamato* mercury mine in Narra Prefecture. This is the second furnace plant the Gould Company has built for the mine. The first unit was installed more than 30 years ago.

CHINA—Recent surveys reveal that China's iron reserves amount to about 3,100,000,000 tons which is sufficient for anticipated industrial demands for the next 60 years. New iron mines have been located in Szecgnan and in the northwest. Large iron deposits will also be developed in Inner Mongolia for *Paotow Steel*. The current rate of China's iron ore production is estimated at approximately 6,000,000 tons annually. Iron from Hainan Island is transported chiefly by sea through the Formosa Straights. It is estimated that steel production should be 11,000,000 tons under the second Five Year Plan, compared with the present annual production of 5,000,000.

MALAYA—The general manager of *Sungei Besi Mines Ltd.* has recommended the installation of two more conveyors as part of a reorganization program which also involves an increase in capacity of the iron treatment plant. As a result, throughput will be raised and it is expected that costs will be reduced from this. It has been necessary to deviate the road and railway leading to the property over a distance of three-quarters of a mile to enable the firm to mine the payable karang along the western side of the present lease area; this will also enable the com-

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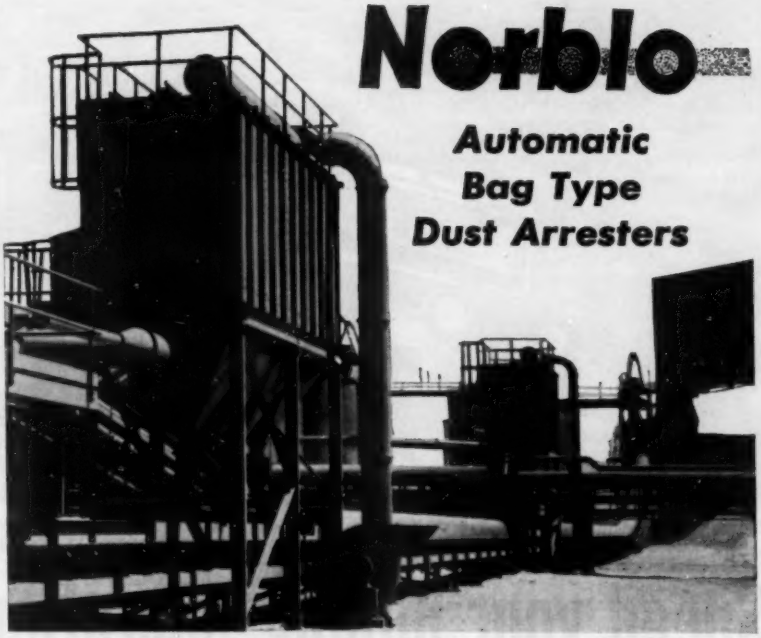

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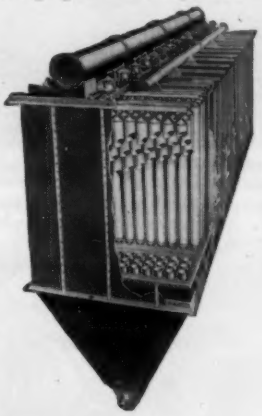

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pany to develop the rich karank at relatively great depth below the present floor of North open pit. Preparatory work is proceeding. The deviation will cost about £100,000. Applications have been filed for drilling permits in Johore and six of these have been granted to Sungei Besi and associated companies. Drilling operations will begin as soon as security arrangements are completed. Since the remaining life of the dredge now operating on the *Pelepah* property is about seven years, every effort is being made to secure another suitable property.

TURKEY—The *Turkish Institute for Mineral Resources Development (MTA)* has located a large colemanite deposit ($Ca_2B_6O_{11}\cdot 5H_2O$) in the vicinity of Kuthaya. Proven reserves are about 5,000,000 tons. The discovery was made while prospecting for lignite deposits.

KOREA—A 720-ton dredge was purchased by the *United Nations Korean Reconstruction Agency (UNKRA)* from the *Yuba Manufacturing Company* in San Francisco, California and delivered to the Taechon-ni area of Korea's southwest coast for operation. UNKRA ordered the dredge after completing a series of drilling tests at a gold placer near Taechon-ni in the province of Cholla Namdo. Their investigations indicated that in an area of some 6,962,000 cubic yards, there was nearly $3,350,000 worth of recoverable gold.

PAKISTAN—The West Pakistan government has decided to set up a *Mineral Development Corporation* similar to the *Pakistan Industrial Development Corporation (PIDC)* for proper development of the mineral resources of the province. The corporation will have an initial capital of Rupees 1 crore; it will engage in mining operations of the known and existing mineral deposits of chromite, bauxite, copper, marble, antimony, and coal, and will also conduct detailed deep drilling surveys of minerals. The corporation would not have a sole monopoly of mining in West Pakistan but would receive preference in obtaining mining leases of important minerals.

MALAYA—The *Pahang Consolidated Company Ltd.* reports that development at the No. 13 and 14 levels of the *Myah* tin mine is not entirely satisfactory but, in spite of this, further shaft sinking would be necessary at a cost of about £250,000. A promising lode has been exposed on the 700-foot level some 3,000 feet north of the ventilation shaft; over a length of 190 feet, 154 feet are payable assaying 3.3 percent tin over a width of 59 inches. The true width of the lode has not yet been exposed.

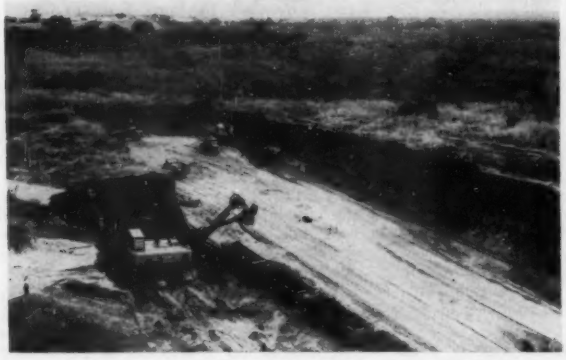
UNION OF SOUTH AFRICA—In addition to its uranium plant which has a treatment capacity of about 80,000 to 100,000 tons a month, the *Harmony Gold Mining Company Ltd.* has erected a pyrite recovery plant which should go into production in the near future. Together with the current tailing from the gold plant, accumulated slimes are being treated at the rate of about 5,000 tons a month; the head value is about 0.5 pound of U_3O_8 per ton.

FEDERATION OF RHODESIA & NYASALAND—*Messina (Transvaal) Development Company, Ltd.* has purchased the *Copper Queen* mine at Umvumas from *Messrs. Tilbury Brothers.* The claim area lies southwest of Sinoia in Southern Rhodesia and has not been worked for some time. The mine has been explored off and on for a number of years, and it is believed to contain a large tonnage of low-grade surface oxidized ore. Little or no work has been done at depth.

LIBERIA—A joint Liberian-American-Swedish group called *LAMCO, (Liberian-American-Swedish Minerals Company)* is reported to have discovered rich iron ore deposits in the northern central province of Liberia. The *Swedish Diamond Drilling Company* is conducting a test drilling program to determine the extent of the deposit. The Liberian government owns half of the shares in LAMCO. Other participants are the *International African-American Corporation* and a group of Swedish mining and industrial firms headed by *Grangesberg Company.* These include *Atlas Copco, Nordstroms Linbanor, Svenska Entreprenad A.B., Skanska Cement A.B.,* and *Ifoverken.* The company is under Swedish management.

UNION OF SOUTH AFRICA—*Buffelsfontein Gold Mining Company Ltd.* has officially gone into production, and, depending upon availability of power, should attain capacity milling rate shortly. Estimated expenditure over the next 18 months on surface construction and underground installations will amount to

Rhodesian Open-Pit Copper Mine in Production at Nchanga



Ore production has started at Africa's newest open pit copper mine —Nchanga—in the Copperbelt of the Federation of Rhodesia and Nyasaland. About 8,000,000 tons of waste have been stripped since April 1955 to uncover this ore. By the end of the year 100,000 tons of ore will be mined from the pit each month with 160,000 per month scheduled in 1958. To maintain this production rate about 1,000,000 tons of waste will have to be stripped monthly. Initial planning called for pit mining to a depth of 700 feet with the final depth to be determined by economic conditions at that future time.

Heretofore, all of Nchanga Consolidated Copper Mines Limited's production has come from underground mining of the Nchanga West ore body. The new pit is being developed to mine a long known, but lower grade deposit, as part of the Fourth Stage Extension which was designed to insure continuance of the present rate of copper output (80,194 tons in 1955) for many years. The life of the mine will also be extended by blending the high-grade, underground, high-cost ore with low-grade, low-cost, pit ore.

Stripping to date has been by rail and truck haulage with waste dumped at several places in accordance with equipment used. Equipment used to date includes: three, Bucyrus Erie 150 B, all-electric shovels; one, Ruston Bucyrus 38 B shovel; Caterpillar-Athey PD 20, semi-trailer, side-dump wagons; Caterpillar DW 21, semi-trailer, side-dump wagons; 60-ton, General Electric, Diesel-electric locomotives; 58-ton, North British, Diesel-hydraulic locomotives; 28-yard, Gregg, side-dump cars; 28-yard, Dorman Long, side-dump cars; Caterpillar D8, bulldozers; and Euclid, end-dump, Diesel trucks.

Beginning in 1958, loading and transport of waste will be radically changed when the two, new, giant, Orenstein-Koppel, bucket wheel excavators go into operation. These excavators will operate against 86-foot-high benches, in contrast to the 50-foot-high shovel benches. These excavators will load a 54-inch-wide, Robins Conveyors, Ltd., belt conveyor which will transport waste to a stacker on one premanent dump 4,300 feet from the pit.

No ore is hauled from the pit proper. Ore from shovels is hauled to and dumped into either of two ore pass raises driven under the pit from the main Nchanga West 625-foot wall haulage level. Ore is drawn from raises into underground cars, hauled to the main shaft, and hoisted to the surface for milling in the flotation plant.

Consulting engineers for the Anglo-American Corporation of South Africa, Limited, together with Nchanga engineers, designed the open pit and the three earlier extension programs.

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about £1,500,000 to establish an adequate ore reserve for the planned milling rate of 100,000 tons a month. The company plans to start uraninum production about the middle of this year.

NIGERIA—A discovery of primary columbite has been made on the *Kuru III* property of *Jantar Nigeria Company Ltd.* So far, only 717 tons have been proved by drilling but there are indications that a considerably larger tonnage exists. The company does not plan to mine this area while the columbite market remains in its present depressed state, but the company will continue to prospect the area. Production during the year ended September 30, 1956, amounted to 305 tons of tin, as compared with 240 tons in the previous year, and 227 tons of columbite, as compared with 216 tons in 1955.

FEDERATION OF RHODESIA & NYASALAND—*Magundi Copper Mines & Minerals Ltd.* is producing 300 tons of copper concentrate monthly at its new plant located at the *Mtuga* mine. Concentrate grade about 30 percent Cu. Depending upon the availability of trucks, chrome production will be resumed soon. The *British Metal Corporation*, through its South African subsidiary, has been appointed sole agent for the sale of all copper concentrates produced by Magundi.

ANGOLA—Some 500,000 tons of iron ore annually will soon be available for export from the Portuguese province of Angola with *Cassinga Mines Ltd.* one of the major producers. By July of this year the Mocamedes Railway will have been extended to a point 400 miles from the port of Mocamedes, and by the end of 1958 this railway will reach Serpa Pinto, nearly 500 miles from Mocamedes. Plans call for an expenditure of £2,000,000 for an overhead conveyor system which would handle ore at Mocamedes where new port installations will be ready this year.

UNION OF SOUTH AFRICA—The joint No. 3 twin-shaft system being sunk by *Welkom Gold Mining Company* to facilitate opening up of its southwestern lease area, as well as to provide ventilation for that future section and *Presidents Brand* and *Steyn* mines, is expected to be completed to a depth of about 4,500 feet by about mid-1958. This section is expected to contribute higher grade ore to the mill feed which will then be increased to more than 100,000 tons monthly. The capacity of the reduction plant is 125,000 tons a month. Surface waste sorting will be introduced in the near future.

NIGERIA—*Jos Tin Area (Nigeria) Ltd.* has purchased 14 leases, three "exclusive prospecting licenses," and other titles for £16,000, and has also taken over the plants and stocks on these properties. The areas acquired are about 50 miles north of Jos's main camp and the communications system is said to be good. The new areas are expected to provide a useful source for tin concentrate and columbite. Production during the period of August-November 1956 amounted to 63 tons of tin concentrate compared with 47.75 tons in the same period of last year.

FRENCH WEST AFRICA—Authorization has been granted the *Caisse Centrale de la France d'Outre-Mer* to loan 7,500,000,000 francs for the alumina project in Fria, French Guinea. This project is being undertaken by *Pechiney* and *Ugine*, along with American and European interests. It provides for mining of about 1,500,000 tons of bauxite annually, which will be refined into 480,000 tons of alumina. Also included in the project is construction of a road to Conakry and expansion of that port.

FEDERATION OF RHODESIA & NYASALAND—December quarter production figures for *Rhodesia Broken Hill Development Company, Ltd.* reveal that zinc output for 1956 reached the new record of 28,925 tons. This compares with 27,900 tons in 1955, which was the previous high. Lead output during 1956 was 15,200 tons compared with 16,050 in 1955.

FRENCH EQUATORIAL AFRICA—*Compagnie Miniere du Congo Francais* will develop lead deposits at Hapilo, five kilometers from *M'Fouati* where the company already operates a mine, according to reports from Paris. The reserves at Hapilo are considered important enough to gradually replace those of M'Fouati which are near depletion. The oxidized ores will be transported by aerial tram to M'Fouati for concentration.

FEDERATION OF RHODESIA & NYASALAND—*Minerals Engineering Company* of Grand Junction, Colorado is constructing a 400-ton-per-day vanadium plant which will treat ores of that area.

UNION OF SOUTH AFRICA—*Zaaiplaats Tin Mining Company Ltd.* has recently installed a bank of spirals which has successfully handled all current tailing and which may also concentrate old accumulated tailing in the near future. The initial production of tin and scheelite concentrates from Stavoren ore is now in progress, and exploratory development of the orebody continues. Satisfactory overall returns have been reported in the opening months of the 1956/57 year, despite some initial variations in sales.

FEDERATION OF RHODESIA AND NYASALAND—*Rhokana Corporation Ltd.* has extended the ore reserves at the *Nkana* and *Mindola* sections by surface drilling; these reserves increased by 22,403,900 short tons to 122,853,200 in the 1955/56 year. The old *Bwana Mkubwa* mine is to be re-explored, as well as other properties. Cobalt plant production was a little more than doubled to 1,111 short tons last year. Various extensions to the concentrator and smelter were completed; two additional roasters were installed in the cobalt plant; a second sulphuric acid unit has been completed; and the construction program at the South Orebody shaft concluded.

BELGIAN CONGO—During the year ended June 30, 1956, *Union Minière du Haut-Katanga* mined 8,905,000 tons of ore, in addition to removal of 10,700,000 cubic meters of barren overburden. The export of uranium-radium concentrates from the *Shinkolobwe* mine continues and a new contract for the sale of uranium contained in these products has been concluded on more favorable terms than before with the buying organization of the United States and the United Kingdom within the framework of the existing agreements between Belgium and those countries.

UNION OF SOUTH AFRICA—*Carrig Diamonds Ltd.* has acquired the major shares in another diamond company and is negotiating for the remainder of the stock. The program of expansion planned for its subsidiary, *Mallin Diamond Mines* in the Rustenburg district of western Transvaal, has received a setback in recent months because of a serious deterioration in mining conditions, aggravated

by the shortage of available Native labor. The expansion program, which involved doubling treatment rate to about 12,000 tons monthly, has been put off until conditions improve. The lease area of Mallin Mines has been extended.

UNION OF SOUTH AFRICA—*Johannesburg Consolidated Investment Company, Ltd.*, has strengthened its holdings in the Roodepoort area through the acquisition of mineral rights in the Roodepoort district from *New Durban Gold and Industrials, Ltd.* These rights embrace full ownership in respect of 441 claims and majority ownership of an additional 549 claims.

NORTH AMERICA

ONTARIO—The *International Nickel Company of Canada, Ltd.* has signed an agreement with the *Texas Gulf Sulphur Company* for the operation of a pilot plant at Copper Cliff to investigate processes for the recovery of elemental sulphur from sulphur dioxide-bearing gases. The joint pilot plant in which Texas Gulf Sulphur will investigate sulphur recovery processes will be built near the site of Inco's new iron ore recovery plant. It will consist of two sections, one for scrubbing and cleaning gas and one for reduction of the sulphur dioxide to elemental sulphur. If the plant findings indicate that commercial production of sulphur at Copper Cliffs is economically possible, plans will be made for production by Texas Gulf.

QUEBEC—*American Smelting and Refining Company* holds the largest interest in a multiple company syndicate which is financing *LeMoyne Ungava Mines Ltd.* in exploration of a copper-nickel belt northwest of Ungava Bay. Other participants are *Sylvanite Gold Mines, Delnite Mines, Lake Shore Mines, Malartic Gold Fields, Teck-Hughes Gold Mines,* and *Lamaque Gold Mines.*

BRITISH COLUMBIA—Good progress is being made by *Empire Development Company, Ltd.* on one of British Columbia's largest new mining projects—at the north end of Vancouver Island. At the open-pit magnetite iron ore mine of *Quatsino Copper-Gold Mines, Ltd.*, construction of a magnetic separation plant has started and a 2,800-foot mine-to-mill tram is being built. The plant will beneficiate up to 3,200 long tons of ore daily. A deep-sea dock capable of accommodating ocean-going ore carriers of 15,000 tons capacity is under construction at Port McNeil. Cost of the project is estimated at $3,000,000.

SASKATCHEWAN—The *Potash Company of America Ltd.* has announced plans for construction of a $20,000,000 treatment plant at the *Patience Lake* property 10 miles east of Saskatoon. Initial schedule calls for completion and production by November 1958. Capacity would be 4,000 to 4,500 tons daily or 1,500,000 tons annually. The company is currently sinking its 3,500-foot shaft. Depth at present is about 925 feet.

NEW BRUNSWICK—*Brunswick Mining & Smelting Corporation* hopes to undertake shaft sinking within the next two years at the *Brunswick* and *Anacon* deposits in the Bathurst district. Also being

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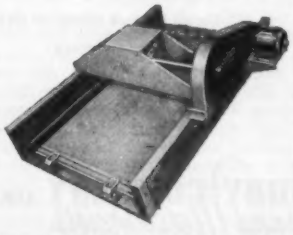

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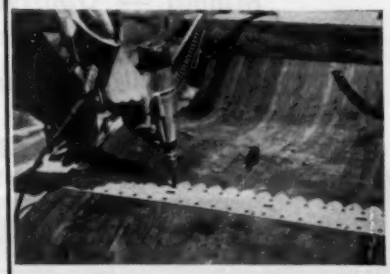

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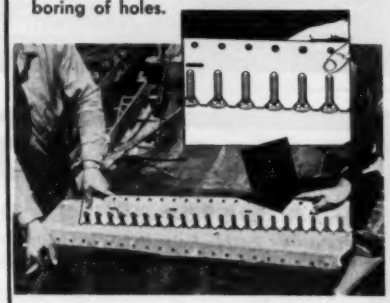

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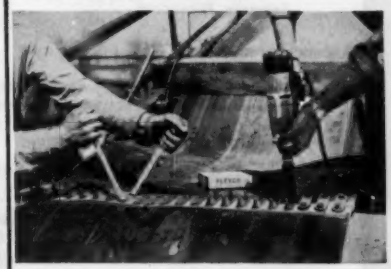

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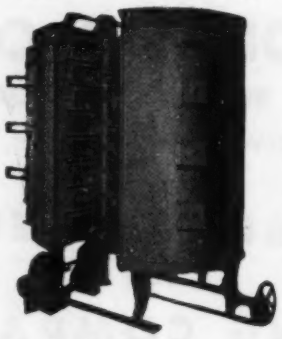

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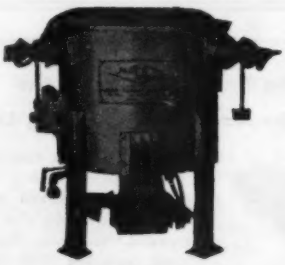

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planned is construction of a 4,000-ton mill somewhere in the county. The company expects to have a solution to the milling problem by August.

ONTARIO—*Strategic-Udy Metallurgical and Chemical Processes Ltd.*, subsidiary of *Strategic Materials Corporation*, has formally opened its prototype electric furnace plant for the low-cost processing of low-grade manganese and other metallic ores. Manganese ore will come from the company's huge deposit in New Brunswick. This ore will also be used for the large commercial plant to be constructed soon near Woodstock, New Brunswick. The latter plant will be designed for an output of 75,000 tons of ferro-manganese annually.

ALASKA—The *U.S. Air Force* is reported to have applied for a withdrawal of land in the Cape Mountain area which, if granted, would prohibit mining within its boundaries. Large reserves of tin-bearing gravel have been proven by placer drilling on Cape Creek in this area, and has only been waiting for suitable financing to be mined.

SASKATCHEWAN—*Black Bay Uranium Ltd.* has purchased 48 uranium-bearing claims in the Beaverlodge area from *Consolidated Nicholson Mines*. A three-compartment shaft will be sunk to 450 feet and three levels will be established. The firm expects to ship to the *Lorado Uranium Mines'* custom mill. Black Bay also plans to start shipping stockpiled ore from its *Gretta* group in the same area to the Lorado mill.

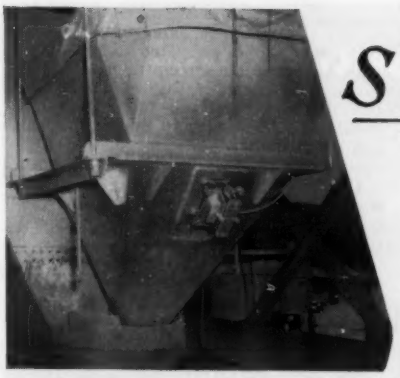
BRITISH COLUMBIA—For the year ended December 31, 1956, *Bralorne Mines Ltd.* milled 131,662 dry tons to recover 63,642 ounces of gold. During the last quarter of the year, the company carried out important development work. This includes several ventilation raises, drifting on the "77" vein 29 level, and the crosscut to the "79" and "77" veins on the 32 level. The "77" vein was rather lean where intersected but values have improved.

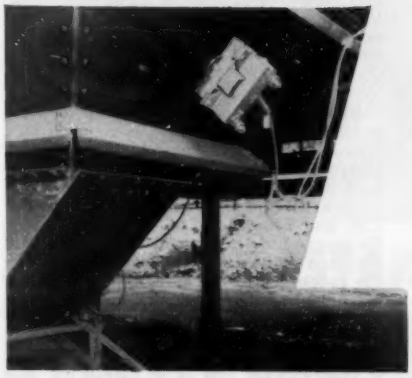
ONTARIO—The Silver Anniversary Meeting and Convention of the *Prospectors and Developers Association* will be held in Toronto March 3 to 6. Included on the program are reports on latest exploration news in Manitoba, Newfoundland, and New Brunswick; the Granduc deposit; Chibougamau accomplishments; iron ore exploration in Quebec; and a general round-up on uranium.

ONTARIO—*Arcadia Nickel Corporation Ltd.* is rushing its underground program in the Sudbury district so that production can get underway by September 1, 1957. The mine is expected to produce 1,000 tons per day as soon as the Rosen shaft is completed; during this period a mill also will be erected.

ALASKA—Preliminary figures released for mineral production in the Territory in 1956 indicate a drop in value last year. Estimated totals for 1956 released by the Territory's Department of Mines show that the value was $24,919,000, compared with $25,412,000 in 1955. A decrease in the value of gold production accounted for much of this. Sand and gravel replaced gold as the leading commodity in terms of dollar value; gold was second, and coal third. Mercury output increased sharply to 3,414 flasks, and chromite showed a slight increase from 7,082 short tons to 7,200 short tons.

BRITISH COLUMBIA—*Granby Consolidated Mining, Smelting and Power*





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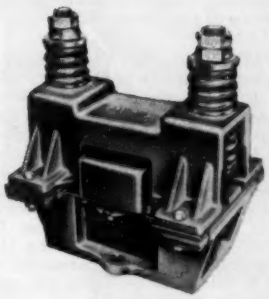

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Company has announced it will close its *Copper Mountain* mine around the end of this month. The lowering of copper prices has caused the shutdown, and only a recovery of prices to the 45-cent level would change the company's plans. The mine is located 160 miles west of Vancouver.

QUEBEC—*Aconic Mining Corporation* is reported to have completed an agreement with the German firm of *Klockner & Company* for erection of an ore dressing and concentrating plant at Aconic's magnetic iron sands property at Natashquan about 210 miles east of Seven Islands. The German firm will provide the $10,000,000 plant, payment for which will come from concentrates—750,000 tons will be provided each year for a five year period, with 267,000 tons per year to be applied toward the cost of the plant. Capacity of the plant is to be 1,000,000 tons of concentrate annually. Partial production is to start in 1959.

ALASKA—The Department of Mines reports that mining claims are being staked in Alaska at the rate of 1,800 per year as compared with more than 20,000 for British Columbia. A comparison of the incentives offered to industry in the two areas will explain the difference, says the Department.

ONTARIO—*Arcadia Nickel Corporation* expects to go into production on September 1, 1957 when it is expected that the second shaft and the necessary mill buildings will be completed. Initial rate will be 1,000 tons per day, but the hoist is capable of handling 2,000 tons daily for future expansion. The second shaft is being sunk near the Rosen zone which is also near the main Robinson zone. Diamond drilling is continuing at the Howland Pit zone where copper-nickel was previously mined in an open pit operation.

BRITISH COLUMBIA—*Cariboo Gold Quartz Mining Company Ltd.* plans to construct a mill at the *French Mines* at Hedley as soon as weather permits.

ONTARIO—A new Canadian engineering company, *Hunting Technical and Exploration Services Ltd.*, has been established in Toronto to work toward better use of natural resources throughout the world. Similar companies are being formed in London and New York City. The new firm will take over and expand the already existing engineering services of the resources survey division of the *Photographic Survey Corporation*. The latter is responsible for the integrated resources inventories now in progress under the Canadian Colombo plan of Pakistan and Ceylon, and for the large mineral survey known as Operation Overthrust being made of 405,000 square miles of the Precambrian Shield in Canada and the United States.

BOLIVIA—*Ventures Ltd.* and *Vitro Corporation of America* have reached an agreement in principle with the Bolivian government for large-scale minerals exploration which will be carried out in the Andes Mountains. A company owned jointly by Vitro and Ventures, *Bolivex Exploration Company*, will carry out the two-year program estimated to cost $200,000. An operating agreement is expected to be reached within a few months and then both airborne and ground surveys should start. The area to be investigated lies in the Bolivian Andes roughly along the borders of Argentina, Chile, and Peru.

CUBA—The *Mesabi Mining Corporation* is reported to be exploring for iron ore in Pinar del Rio Province. The work is being done at the *Los Ciegos* and *Los Granadillos* concessions near Mantua.

MEXICO—Mexico continued to hold first place last year as a silver producer despite a marked drop in output as compared with other years. Production in 1956 totaled 44,000,000 fine ounces, compared with 48,000,000 ounces in 1955 and 50,400,000 ounces in 1950. Last year the Mexican government used 4,748,000 ounces of silver for minting; Mexican silversmiths used 3,000,000 ounces; 18,000,000 ounces were exported, largely to West Germany.

PERU—*Minerals, Inc.* has decided not to develop the *Chavin* mine and its option will lapse. Purchase price had been $2,400,000, of which Minerals Inc. paid $10,000 upon execution of the contract with *Consolidated Guayana Mines Ltd.* and *Frobisher Ltd.*, subsidiaries of *Ventures, Ltd.* of Canada. Consolidated Guayana will continue development of the property as soon as new financing is completed. A five-kilometer aerial tramway will be built from the mine, located at 13,200 feet, to a site for a 150-ton-per day mill at 7,000 feet. Work is expected to start in 1957 and to be completed in mid-1958. Ore reserves are estimated at 270,000 metric tons of positive and probable ore, and 80,000 tons of possible ore, assaying 8.0 percent lead, 12 percent zinc, 0.8 percent copper, 4.1 ounces silver, and 0.008 troy ounces gold per metric ton.

BRAZIL—First shipments of manganese ore from the *Amapa* deposit on the Amazon River have been made. *Industria e Comercio de Mineros* S.A. (ICOMI) has been developing the property since its discovery in 1946. *Bethlehem Steel Company* owns 49 percent of the firm, with the Brazilian government holding the remaining 51 percent. *Foley Brothers* of New York have done much of the construction work, including building of Porto Santana and a 135-mile jungle railroad. Geologists have already estimated about 10,000,000 tons of manganese ore assaying 60 percent or better. (See MINING WORLD, May 1955, page 67.) According to recent plans, ICOMI expects to export 700,000 tons of ore in 1957.

MEXICO—Sanchez Hermanos has started to explore his manganese property at Autlan, state of Jalisco, which adjoins the *San Francisco* mine being developed by *Cia. Minera de Autlan*. The latter firm is shipping about 4,000 tons of manganese ore per month from the property. Mr. Sanchez expects to cut the same ore body.

CUBA—*Tiara Mines, Ltd.* of Toronto, Canada, has obtained five mineral concessions in Pinar del Rio Province. Copper veins as wide as 40 feet are reported on the property.

BRAZIL—According to recent reports, a cinnabar deposit has been located in the state of Amazonas near the Urubus River.

CUBA—*Las Margaritas* mine at El Caney in Oriente Province exported 420 tons of manganese dioxide during 1956. *La Rosita* mine at Barajugua in Oriente mined and exported 320 tons.

MEXICO—Jose Camou has leased the *La Dicha* mine in the municipality of Chipancingo, state of Guerrero to some Canadian capitalists. They have started to explore the property by diamond drilling and have located some high-grade copper ore.

PERU—*Cerro de Pasco Corporation's* huge $31,000,000 Paucartambo hydroelectric project has gone into operation. Initially, the plant will supply 65,000 kilowatts of power to the copper, lead, and zinc refineries at La Oroya. This can be increased to 100,000 kilowatts with the addition of two more generators, bringing the total to five.

ARGENTINA—During the first six months of 1956, the following minerals were exported: wolframite, assaying up to 65 percent WO_3, 669,447 kilograms; scheelite, assaying up to 60 percent WO_3, 582,147 kilograms; beryl, assaying up to 10 percent BeO, 400 tons; and mica, 134,600 kilograms.

MEXICO—Strong indications of commercially valuable titanium deposits are said to exist on the Revillagigedo Islands off the coast of Baja California, the base of which is Socorro Island. Mexico has sent a naval force to reclaim, explore, and map plans for converting to national economic and social good, according to the

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Navy Department. Investigations by the National Institution for the Investigation of Natural Resources are to be sent to the island to check the titanium report.

BOLIVIA—Smelting tests reportedly are being carried on in the *Krupp* plant in Germany on Bolivian tin ores. Tests with the Waelz volatilization procedure appear to be encouraging, making a high-grade dust from very low-grade concentrates.

BRAZIL—Engineer Sa Lessa, president of *Companhia Vale do Rio Doce* in Minas Gerais, returning from a trip to the United States and Europe, has announced that his company has already sold 2,400,000 metric tons of iron ore to be shipped in 1957. This sale correspondes to the annual output mined by the company. The selling price was at an average of U.S. $14.50 per metric ton.

CUBA—Six mines at Mayari in Oriente Province, produced 1,874,320 pounds of nickel oxide in powder form and 7,285,377 pounds of granulated nickel oxide during the last quarter of 1956. Exports were 1,616,012 pounds of powdered oxide and 7,354,097 pounds of granulated oxide.

PERU—A growing interest in the mining business was reflected in several developments last year. More mining equipment was imported than usual; there was a greater demand for shares in mining companies; exploration and development in old claims and many new claims increased over the year. Besides the incentives offered by Codigo de Mineria and the fair prices for metals, there was also an expanding market in Europe for mineral exports because of the political unrest. Therefore, during the last three months of the year, more mineral exports went to the European continent than to the United States—the usual market for Peruvian ore.

BOLIVIA—The Japanese mining industry will send Japanese mining engineers and geologists to Bolivia under a contract recently negotiated between the two countries. Bolivia will also purchase Japanese mining equipment under a barter trading system for mineral resources.

MEXICO—*Productos Industriales S.A.* of Guadalajara has been exploring the *La Rosa Amarilla* mine in the Cuautitlan mining district, state of Jalisco, where there appears to be a substantial tonnage of low-grade copper ore. The firm is now constructing a leaching plant to treat the ore with dilute solutions of sulphuric acid. The ore averages 4.0 percent Cu with about 60 to 80 grams of silver per ton. The vein also carries some pockets of high-grade ore which is sorted and shipped to the *American Smelting and Refining Company's* smelter at San Luis Potosi. Since the ore is highly silicious, the product will be a copper cement which will be sent to the firm's Guadalajara treatment plant for production of copper sulphate. Juventino Munguia is general superintendent at the operation.

BRAZIL—The National Department for Mineral Production has surveyed a large bauxite deposit located at the mouth of the Maracume River on the borders of the states of Para and Maranhao. About 10,000,000 tons is estimated to be in the deposit. The department's laboratories are now analyzing the ore and average alumina content is reported to range from 30 to 40 percent. *Kaiser Aluminum & Chemical Corporation* has had a crew in Brazil prospecting for bauxite during the past year.

The tough ones come to Card

How HOMESTAKE solved two HAULAGE PROBLEMS

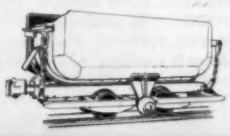
When Homestake Mining Company needed larger haulage capacity, Card engineers were called in. At Homestake, ore cars are automatically dumped while in motion, and haulage ways are limited in cross section. So, special Granby-type cars were chosen to replace the old gable-bottom cars.

Since 1939, 390 of these special Card cars have gone to Homestake on eight successive orders. Designed for maximum capacity, they have only a very minimum of side clearance. They are fabricated wholly of Cor-Ten plate and hold 60 cu. ft. Greatest design change over the years has been to a heavier liner plate to allow loading without the degree of ore fragmentation originally planned. Originally the cars were loaded through 14" grizzlies. Now they are loaded with the largest sizes that will clear the chutes.

Card has recently furnished 61 special Rocker Dump cars for development work at Homestake. These are well suited to handling waste and dumping in old stopes.

WHERE MINING CALLS

for efficient haulage, Card cars are the tested answer. Join Card's many customers. Their repeat orders are added proof of quality for you. Card engineers are at your service . . . no obligation.



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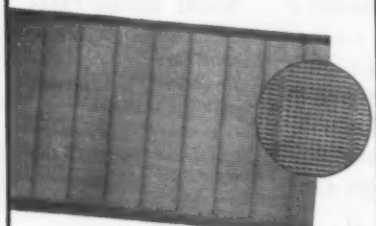

MARCEL TYPE SCREEN! This screen, as all WEDGE WIRE products, gives long life and non-blinding operation. Maximum dewatering efficiency is combined with a wavy type of screen preventing objectionable slivers passing through. This keeps the end product uniform.

Wedge-Wire CORPORATION
Gas Street at Nickle Plate R. R.
Wellington, Ohio

U.S.A. Metal & Mineral Prices

METALS

		February 15, 1957
COPPER:	**Electrolytic.** Delivered F.o.b. cars, Valley basis	34.00¢
	Lake. Delivered, destinations, U.S.A.	34.00¢
	Foreign Copper. Valley basis	34.00¢
	Custom	33.00¢
LEAD:	**Common Grade.** New York	16.00¢
ZINC:	**Tri-State Concentrates,** jig, flotation 80% lead, per ton	$201.32
	Prime Western: F.o.b. E. St. Louis	13.50¢
	Prime Western; Delivered, New York	14.00¢
	Tri-State Concentrate, 60% zinc, per ton	$84.00
ALUMINUM:	**Primary 30 Pound Ingots (99% plus).** F.o.b. shipping points	27.10¢
ANTIMONY:	**Lone Star Brand.** F.o.b. Laredo, in bulk	33.50¢
BISMUTH:	(In ton lots) price per pound	$2.25
CADMIUM:	**Sticks and bars.** 1 to 5 ton lots (Price per pound)	$1.70
COBALT:	**97.99%,** keg of 550 pounds (Price per pound)	$2.35
COLUMBIUM:	**Powder**	Nom., per pound $120.00
GERMANIUM:	**Germanium:** dioxide, high purity, gram	27.50¢
LITHIUM:	**98%** (per pound)	$11.00-$14.00
	Carbonate	82.00¢
MAGNESIUM:	**Ingots (99.8%)** F.o.b. Velasco, Texas, per pound	36.00¢
MERCURY:	**Flasks.** Small lots, New York	$255.00-$257.00
NICKEL:	**"F" Ingots (5 pounds).** F.o.b. refinery, Port Calbourne, Ontario	74.00¢
SELENIUM:	**99.5%,** per pound	$12.00
	per kilogram	$43.00
THORIUM:	**Grade A Brands.** New York (Price per pound) Prompt delivery	$1.0275
TIN:	**99.3%** + Grade "A" Sponge (Price per pound)	$2.75
TITANIUM:	**Nominal,** per kilogram	$40.00
URANIUM:	**Nominal,** per kilogram	$11,000.00
U-235:	**United States Treasury Price**	$35.00 per ounce
GOLD:	**Newly mined domestic.** United States Treasury price	90.5¢
SILVER:	**Foreign** Handy Harmon	91.37¢
PLATINUM:	**Per Ounce**	$98.00-$101.00
ZIRCONIUM:	**Sponge, Per Pound,** Nominal	$10.00

ORES AND CONCENTRATES

BERYLLIUM ORE:
10 to 12% BeO. F.o.b. mine, Colorado — $45.00 per unit
Small lot purchases at Custer, S. D., Spruce Pine, N. C., and Franklin, N. H. Visual inspection at $400.00 per short ton or by assaying at: 8.0 to 8.9% BeO, $40 per unit; 9.0 to 9.9%, $45; over 10.0%, $50.

CHROME ORE:
F.o.b. railroad cars eastern seaports. Long tons dry weight.
African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio — $56.00-$57.00
African (Transvaal). 48% Cr_2O_3. No Ratio — $40.00-$41.00
Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio — $60.00
U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3.

COLUMBIUM-TANTALUM ORE:
At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12, 1956.)
Per Pound Pentoxide. — $1.15-$1.30

IRON ORE:
Lake Superior. Per gross ton Lower Lake Ports
Mesabi, Non Bessemer, 51.5% Fe. — $11.45
Mesabi, Bessemer, 51.5% Fe. — $11.60
Old Range Non Bessemer. — $11.70
Old Range Bessemer. — $11.85
Swedish, Atlantic Ports, 60 to 68% Fe. Contracts, Per Unit — 28.00¢

MANGANESE ORE:
Metallurgical grade. 48 to 50% Mn. Long ton unit — $1.60-$1.75
Metallurgical grade. 46 to 48% Mn. Long ton unit — $1.55-$1.65
Metallurgical grade. 44 to 46% Mn. Long ton unit — $1.45-$1.55
Domestic U. S. Government ore purchasing depots: Butte, Montana; (black and pink ores) base price of $4.87 per long dry ton of 18% manganese ore. Phillipsburg, Montana; base price of $6.43 per long ton unit of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) $2.30 per unit with premiums and penalties.

MOLYBDENUM CONCENTRATE:
90% MoS_2 F.o.b. Climax, Colorado. Per pounds of contained molybdenum, plus cost of containers — $1.10

TUNGSTEN CONCENTRATE:
Domestic. 60% WO_3 Per short ton unit — $55.00
Foreign. 65% WO_3 Per short ton unit (Scheelite) — $27.00
Foreign. South American, Spanish, Portuguese — $26.00

URANIUM ORE:
Carnotite-Roscoelite. F.o.b. purchase depot plus $0.06 per ton mile ($6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado. Salt Lake City, Thompsons, Moab, White Canyon, Green River, and Monticello, Utah. Shiprock, and Grants, New Mexico, Edgemont, S. Dakota, Riverton, Wyoming, Tuba City, and Cutter, Arizona. Base price for 0.10% ore is $1.50 per pound and up to $3.50 per pound of contained U_3O_8 plus $0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of $0.25 per pound for each in excess of 10 pounds. A $0.50 per pound development allowance paid on all ore purchases. Special lime schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment.

VANADIUM ORE:
Carnotite-Roscoelite. V_2O_5 in ratio of more than 10 parts to 1 part of U_3O_8 are generally acceptable at all AEC depots, but excess not paid for at Marysvale, Monticello, and Bluewater. Shiprock has no limit on V_2O_5 to U_3O_8 ratio and all contained V_2O_5 is paid for — Per Pound V_2O_5 $0.31

NON-METALLIC MINERALS

BENTONITE:
Minus-200-mesh. F.o.b. Wyoming points. Per ton in carload lots — $12.50
Oil Well grade. Packed in 100 pound paper bags — $14.00

FLUORSPAR:
Metallurgical grade. 70% efective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines — $40.00
Mexican. 70% F.o.b. border — $24.00-$24.50
Acid Grade. 97% CaF_2, Bulk, F.o.b. Kentucky, Illinois, Colorado — $55.00
Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, $34.50 per ton, others $28.50; 70% Ill.-Ken. $38.50, others $32.50.

PERLITE:
Crude: F.o.b. mine per short ton — $3.00 to $5.00
Plaster grades. Crushed and sized. F.o.b. plants — $7.00 to $9.00

SULPHUR:
Long ton, F.o.b. Hoskins Mound, Texas — $25.50
Export — $30.50

LONDON METAL AND MINERAL PRICES

		February 15, 1957	Per Long Ton	USA Equivalent cents per pound[1]
COPPER:	**Electrolytic spot**	£244	10s 0d	30.56¢
LEAD:	**Refin$_{ed}$ 99%**	£112	5s 0d	14.03¢
ZINC:	**Virgin, 98%**	£ 99	0s 0d	12.37¢
ALUMINUM:	**Ingot, 99.5%**	£197	0s 0d	24.625¢
ANTIMONY:	**Regulus, 99.6%**	£222	10s 0d	27.81¢
TIN:	**Standard, 99.75%**	£764	0s 0d	95.50¢
TUNGSTEN:	**Long ton unit**	$27.02		

With Sterling pound at $2.80.

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

Marquette Iron

Continued from page 46 (WM29)

deck 2-inch square openings. Tertiary crushing is in 7-foot Symons short head.

Conveyor belts lead to scissor switch tower between secondary and tertiary crushers to gain elevation for screening feed to tertiary crusher. Belts are equipped with Dings metal detectors. Fresh air from outside the crusher building is piped to and blown thru crusher motors for cooling.

Fine ore storage: A 4,000 ton catenary steel bin makes crushing necessary on only the day shift. Ore from this bin is split to one of two essential identical milling units—Nos. 1 and 2. The only difference is in the flotation sections, and will be described. Ore is drawn from the bottom of bin by six Link-Belt feeders with variable speed drives to control flow rate. Where ore drops from individual feeders to conveyor belt a fine water spray holds down dust. Ore is weighed by a Conveyoflo scale on the way to the rod mill.

Conditioning: Stage conditioning is used with the readily floatable fine fraction (secondary cyclone underflow) going directly to the fourth and last conditioner. If the fine fraction was subjected to the four stages of conditioning that the coarse fraction (densifier sand) gets, there would be promotion of undesirable fine silica. The four conditioners are each 4 by 4 by 4 feet in size with Denver turbine type impellers for agitation. Conditioning time for four stages is 10 minutes.

Flotation circuits operate at pH of 7.1. Rougher concentrate grade is 52.0 percent iron, and recleaner (final concentrate) between 62.0 and 65.0 percent.

Thickening-filtering: Flotation concentrate is pumped to a 30-foot Dorr-Oliver thickener. Overflow is returned for mill reuse: water and underflow are pumped to an 8 by 10 foot Eimco drum filter. A spare filter is available for use as needed. Filter cloth must be synthetic to prevent blinding. Both Seran and Polyethylene have been used. Seran has given best results. Filter cloth patching is easily done using airplane type fabric dope as cement for patches. Concentrate is conveyed to the loading pocket, from which it is drawn directly into railroad cars for shipment to Marquette Iron Mining Company's Eagle Mills pelletizing plant, or trucked to the nearby stock piling area.

Steel consumption: It is too early to know the length of primary crusher wearing parts. Secondary crushing liners were replaced after 250,000 tons, and tertiary liners after 200,000. The rod and ball mills each use 1.25 pounds of steel per ton of feed.

Manpower: The crushing plant operates on day shift only with five men: two primary, two secondary, and one clean up man. The concentrator proper operates with a crew of five operators on each of three shifts. They are: one grinding circuit operator, one filter operator, one helper, one car loader, and the shift supervisor. Each shift normally produces 400 long tons of concentrate.

A New Era For Marquette

The Republic flotation mill and the Eagle Mills pelletizing plant, described in the December 1956 issue of MINING WORLD, page 42, have started a new era on Michigan's Marquette Range. These plants have created a premium blast furnace feed from heretofore valueless iron formation. Marquette Iron has proven that Michigan jaspelite can successfully compete most favorably with the much publicized Minnesota magnetic taconite.

Without doubt, Marquette Iron is expansion minded.

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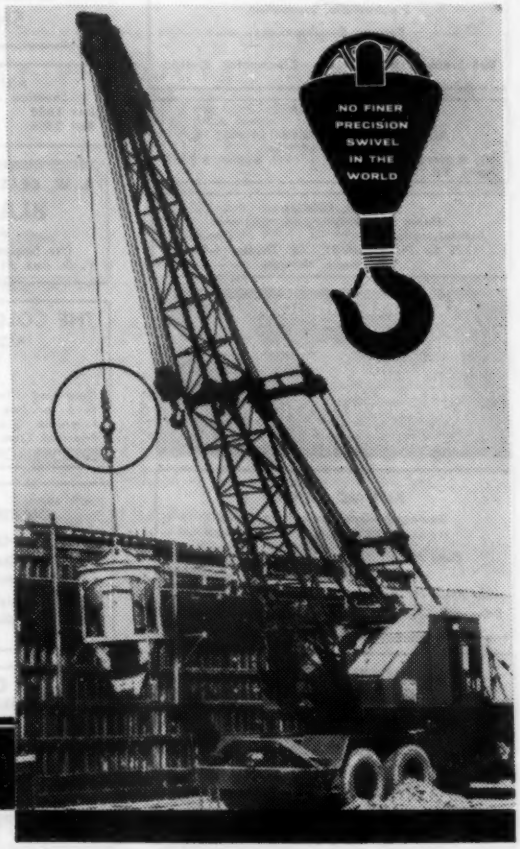

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Continued on page 125

(Continued from page 124)

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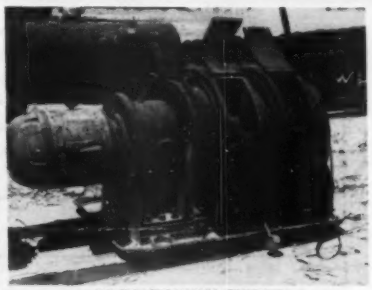

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3 —4' Symons Std. Cone Crusher
100—Std. Diester Concentrating Tables
1 —3000 CFM I-R PRE-2 Compressor
1 —2000 CFM I-R PRE-2 Compressor
14 —86 Marcy Ball Mills
1 —800 HP Nordberg 2-Drum Mine Hoist (Can be converted to 1600HP)

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1—7' x 7' Marcy
1—8' x 6' Marcy
1—6' x 8' Allis-Chalmers
1—8' x 48" Hardinge Conical
1—7' x 36" Hardinge Conical
1—5' x 5' Allis-Chalmers (New liners)

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2—42" x 42" Pan American Duplex
3—12" x 18" Denver Duplex
1—24" x 36" Denver Duplex
1—42" x 42" Duplex Yuba Placer, like new.

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2—36" x 72" Jeffrey-Traylor Grizzly Pan
2—24" x 5' Denver Adj. Stroke
1—24" x 8' Denver, Adj. Stroke
2—8" x 36" Jeffrey-Traylor Vibrating Feeder, 440 Volt.

Vibrating Screens

1—3' x 12' Allis-Chalmers, lowhead, 1 deck
1—3' x 8' Link Belt, 1 deck
1—3' x 6' Symons Rod Deck, 1 deck
1—3' x 8' Denver Dillon, 2 deck

Crushers

1—36" Telsmith Gyrasphere
1—28 x 36 Traylor—75 HP
1—10 x 16 Pacific
1—20 x 36 Universal
1—30 x 42 Farrell-Bacon
1—9 x 36 Cedar Rapids
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2—8-cell Fagregen 56" x 56", Model HS
1—8-cell Gallgher, 48" x 48", 2 cell units
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1—6-cell #30 Denver, Sub A

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1—5'4" x 6' Oliver Drum
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1—6' 5-leaf Oliver Disc
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6—8" New Morse Lab Pulverizers
1—Gates #00 Lab Gyratory Crusher
1—McCully #1 Lab Gyratory Crusher
2—Stearns-Roger Lab Batch Ball Mills
1—8" x 60" New Morse Lab Classifier
2—500 Gram Denver Lab Flotation Cells
1—1000 Gram Morse Lab Flotation Cells
4—2000 Gram Denver Lab Flotation Cells
2—Stearns-Roger Lab Pressure Filter
1—18" x 27" Revolving Lab Dryer
1—16" Lab Pug Mill

SCREENS

1—18" x 58" Traylor Vibrating Screen
1—34" x 12' Symons Single Deck Screen
1—3' x 8' Simplicity 3 deck Screen
1—4' x 12' Tyler 2 deck Screen

FILTERS

2—4' x 2' Morse Drum Filters
1—3' x 4' Oliver Drum Filter
1—4' x 8' Eimco Drum Filter
1—6' x 8' Morse Drum Filter
1—4'—2 disc Denver Leaf Filter
1—6'—2 disc American Leaf Filter
1—6'—2 disc Oliver Leaf Filter
1—6'—5 disc Morse Leaf Filter
1—18" Morse Filter Press
1—36" Sweetland #12 Filter Press

COMPRESSORS

1—42 CFM Ingersoll-Rand NE-1
1—44 CFM Ingersoll-Rand ER-1
1—50 CFM Quincy VC-2
2—88 CFM Ingersoll-Rand ER-1
1—120 CFM Ingersoll-Rand ER-1, 8" x 6"
1—161 CFM Chicago-Pneumatic PB-2
1—179 CFM Ingersoll-Rand NE-1
1—198 Sullivan WL-80
1—293 CFM Ingersoll-Rand Type 10
1—364 CFM Sullivan WG-9
1—445 CFM Worthington M-80
1—447 CFM Ingersoll-Rand Type 10
1—637 CFM Sullivan WJ3
1—698 CFM Union Low Pressure
1—800 CFM Ingersoll-Rand Type 10
3—105 CFM Ingersoll-Rand Portable Gas Engine Driven, Rubber Tire Mounted
1—105 CFM Schramm Portable, Gas Engine Driven, Rubber Tire Mounted
1—105 CFM Ingersoll-Rand, Portable, Gas Engine Driven
1—310 CFM Sullivan Portable, Gas Engine Driven

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1—4' x 4' Marcy Ball Mill
1—6' x 48" Hardinge Conical Ball Mill
1—8' x 22" Hardinge Conical Pebble Mill
1—3' x 8' Marcy Rod Mill

AIR TUGGERS

1—Ingersoll-Rand model D6U
5—Gardner-Denver model HK
1—Sullivan model L-111
2—Joy "Turbinair" model F-113
1—Ingersoll-Rand model HU
1—Gardner-Denver model HM

ELECTRIC SLUSHERS

1—5 HP Brownie tugger model HG
1—5 HP Sullivan tugger model DE
2—7½ HP Sullivan tuggers, model HE
5—5 HP Sullivan 2 drum model HDE
1—10 HP Sullivan 3 drum model HDE-10
1—15 HP Joy 2 drum model AF-212
2—20 HP Ingersoll-Rand 2 drum model 20NM
1—50 HP Sullivan 2 drum model CF-211

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Longyear Wire Line equipment allows more drilling time per shift . . . improves core recovery!

Another core sample heading for the box and the crew about to go for more *without pulling up the drill string.* That's drilling with Longyear Wire Line equipment!

Drillers using the Longyear Wire Line Core Barrel lower an "overshot" through the drill string to bring up the Inner Tube containing core. Here's what this can mean to *your* operation:

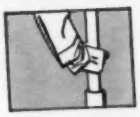
1 The drill string normally remains in the hole except when it is necessary to replace the bit. This eliminates much of the hard labor of drilling and allows more actual drilling time per shift.

2 Caving, the major cause of blocking and bit damage, is minimized. There is little chance for caving while the drill string is in the hole—which is most of the time.

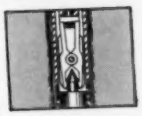
3 Longyear Wire Line Core Barrels are equipped with the water shut-off valve. In closed circuit drilling (possible with Longyear transmission pumps), the shut-off valve gives an immediate, positive indication of a block in the core barrel, eliminating costly "hunches" on the part of the drill runner.

Wire Line experience includes hundreds of thousands of feet drilled in many kinds of formations. Reports consistently show lower costs per foot of core recovered. In one overseas operation, switching from conventional NX equipment to BX Wire Line increased footage from ten to forty-seven feet per shift. In most cases when drilling in ground that is difficult to core, Wire Line improves core recovery substantially.

Looking ahead to your next drilling project, keep in mind that Longyear offers a complete line of Core Barrels and expert technical assistance in the selection of the right equipment for the formation you want to drill.



At end of core run, overshot assembly is lowered by wire through drill string.



At bottom drill string, overshot latches on to spear of inner tube.

Core-bearing inner tube reaches the surface, is freed from overshot.

Core is removed. Meanwhile, stand-by inner tube is dropped into the hole so drilling can be resumed as soon as it is in position.

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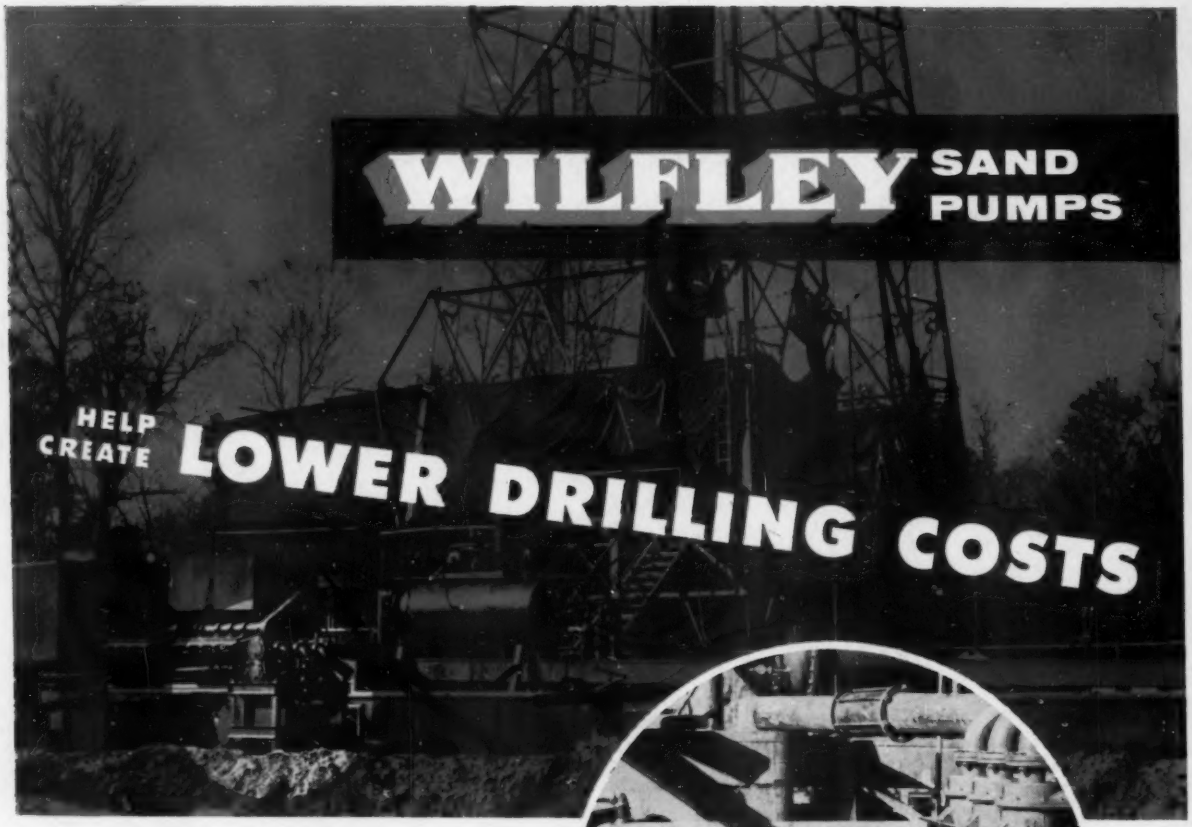

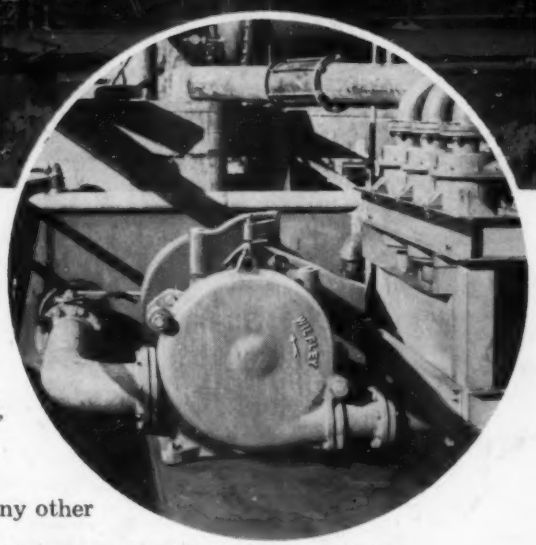

The multiple cyclone unit, used in this oil drilling operation for removing sand and abrasive solids from drilling muds, makes possible 20% faster drilling, increased bit footage, 25% longer runs, reduced mud pump maintenance and many other cost-saving advantages. A vital factor in the economy of this operation is the Wilfley Sand Pump which provides: maintained high efficiency; continuous, trouble-free operation without attention; simple and speedy replacement of long-wearing parts.

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